MODEL D600

18

LOWREY®

SERVICE MANUAL

MX-1

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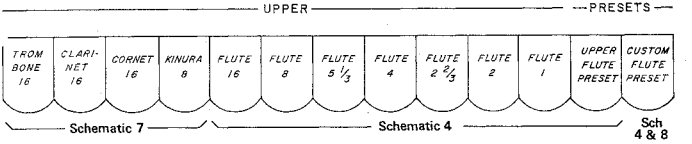
LOWREY MX-1, Model D600
A completely solid state, self-contained consolette organ with two 49-note keyboards and 18 pedals. The organ includes six amplifiers and seven full fidelity speakers:
Two 10-inch Bass Speakers (mounted in acoustic enclosure)
Two 6 x 9-inch Chorus Speakers
One 8-inch Main Speaker
Two 8-inch Flute Speakers

Dimensions

Height:	41-9/16 inches (1056mm) (without Music Rack)
Width:	50-3/8 inches (1280 mm)
Depth:	28-3/4 inches (731mm)
Weight:	357 lbs. (162kg)

SPECIFICATIONS



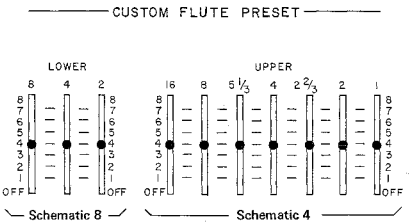
FLUTE 5-1/3
No sustain, Golden Harp or AOC effect.
Keys tone 7 keys to right of 8-foot tone
(i.e. 5-1/3-foot G same tone as 8-foot D)

FLUTE 2-2/3
No sustain, Golden Harp or AOC effect.
Keys tone 7 keys to right of 4-foot tone
(i.e. 2-2/3-foot G same tone as 4-foot D)

FLUTE 1
C#4 to C5 repeat C#3 to C4 tones.

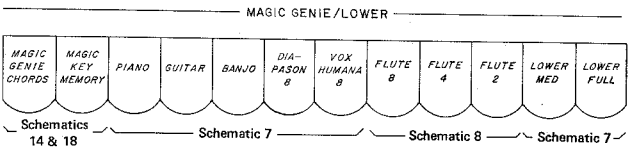
UPPER FLUTE PRESET
Factory set to select 16-, 4-, 2-2/3- and 2-foot Flutes.
Does not disable other Flute tabswitches.

CUSTOM FLUTE PRESET
Enables Custom Flute Preset Slider Pots for customizing Upper and Lower Keyboard Flutes.
Disables Upper Flute Preset and Upper Flute tabswitches.



These Slider Pots control the volume level of all the flute footages on upper and lower manual when Custom Flute Preset tabswitch is on.

(Note: Due to fundamental and harmonic enhancement or suppression, Reed and String sounds can be created by these sliders.)



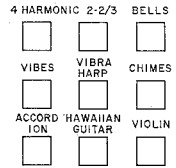
MAGIC GENIE CHORDS
Causes chords to be constructed from one keydown. Chords can be minored, augmented, diminished or 7th added in same manner as for Orchestration Plus. Chords hold until all keys are released and any key is re-keyed.
The effect of this tabswitch on Orchestration Plus is the same as the Chord Logic button.

MAGIC KEY MEMORY
Causes Lower Keyboard keys to hold until all keys released and any key is re-keyed.
The effect of this tabswitch on Orchestration Plus is the same as the Chord Logic button.

PIANO GUITAR BANJO
Modulated at Rhythm Speed with Rhythm on.
Volume controlled by Genie Slider Pot.

LOWER MED. LOWER FULL
Control volume of Lower R/S and Flute voices except Piano, Guitar and Banjo.

ORCHESTRAL PERCUSSION



Switches: Schematic 18

LED's: Schematic 16

Filtering: Schematic 7

Harmonic 4, 2-2/3 and Bells presets do not cancel each other, but when selected will cancel any previously selected preset in the bottom two rows. Selecting a preset in the bottom two rows will cancel any previously selected presets in this section.

HARMONIC 4
4-foot Flute voice with percussive envelope

HARMONIC 2-2/3
2-2/3-foot Flute voice with percussive envelope

BELLS
4-foot Percussive Flute voice with strike tone

VIBES
16-foot Flute voice with tremolo and percussive strike tone attack

VIBRA HARP
16-foot Flute voice with tremolo

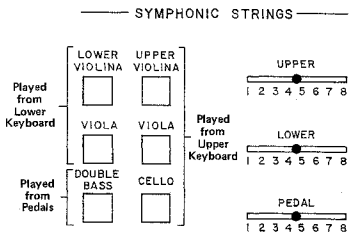
CHIMES
Combination of 4 - 4-foot Flute tones with percussive envelope.
Chimes cancels upper tabswitch voices, and can be played only from G2 to C5 on Upper Keyboard.

ACCORDION
16-foot R/S voice with Slow Attack envelope

HAWAIIAN GUITAR
A phase modulated 8-foot R/S voice.

VIOLIN
A phase modulated 4-foot R/S voice.

The volume for the Orchestral Percussion Presets is controlled by the Percuss Control in the Effects Potentiometer section.



Switches: Schematic 18
LED's: Schematic 17
Filtering - Upper: Schematic 6
Lower: Schematic 9
Pedal: Schematic 12

All presets in this section do not cancel each other, and are phase modulated by the three channel chorus circuit on Schematic 11.

LOWER VIOLINA
4-foot Lower Keyboard String voice, Volume Controlled by Lower Slider.

UPPER VIOLINA
4-foot Upper Keyboard String voice, Volume Controlled by Upper Slider.

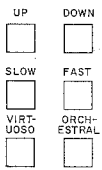
LOWER VIOLA
8-foot Lower Keyboard String voice, Volume Controlled by Lower Slider.

UPPER VIOLA
8-foot Upper Keyboard String voice, Volume Controlled by Upper Slider.

DOUBLE BASS
16-foot Pedal Keyboard String voice, Volume Controlled by Pedal Slider.
Will not play if an Orch. Plus style is being used.

UPPER CELLO
16-foot Upper Keyboard String voice, Volume Controlled by Upper Slider.

GOLDEN HARP



Switches: Schematic 18
LED's: Schematic 16

The Golden Harp feature plays a continual arpeggio or virtuoso pattern through the Upper Keyboard (Schematic 3) or Orchestral Symphonizer (Schematic 22) keying circuitry. The notes that comprise these patterns are calculated by the microprocessor from Lower Keyboard keydown information. The speed of the Harp is controlled by the Digital Rhythm Speed control and the Fast/Slow pushbuttons in this section. This feature can be activated by the Golden Harp/Minor Footswitch on the right hand side of the expression pedal. If the Magic Genie chord tabswitch is on, the Golden Harp/Minor Footswitch functions as a Minor switch and Golden Harp is activated when selecting the Up and/or Down pushbuttons.

Up-Down - causes arpeggio or virtuoso pattern to progress in an upward or downward direction. If both pushbuttons are selected, the pattern progresses Up and Down.

Slow - the speed slows to 1/2 of the Digital Rhythm Speed Display.

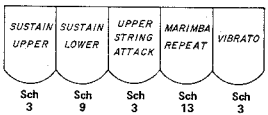
Fast - the speed is twice that of the Digital Rhythm Speed Display.
If both Slow and Fast are selected, the speed equals that of the Digital Rhythm Display which is equivalent to both buttons being off.

Virtuoso - causes the Golden Harp arpeggio pattern to periodically reverse direction as it progresses in an upward or downward direction.

Orchestral - causes the Golden Harp effect to be transferred to the Orchestral Symphonizer voices if an Orchestral Symphonizer voice is also selected. When the Orchestral Golden Harp button is selected, the Orchestral Symphonizer voices cannot be keyed from the upper keyboard.

Note: Golden Harp will play on all the Orchestral Percussion voices except Harmonic 2-2/3. However, any of these voices that pass through the Percussion/Slow Attack Modulator IC1 (Schematic 7) will require an upper keyboard keydown before the Golden Harp effect is heard.

EFFECTS



SUSTAIN UPPER
Enables Sustain Slider Pot for sustain length control of Upper Keyboard Tabswitch and Symphonic String voices and some Orch. Percussion presets.

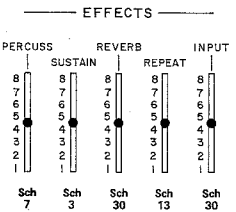
SUSTAIN LOWER
Switches in fixed amount of sustain for Lower Keyboard tabs and Symphonic String voices.

UPPER STRING ATTACK
Gives Slow Attack effect to Upper Symphonic String voices Violina, Viola and Cello.

MARIMBA REPEAT
Causes an alternating repeat on Upper Tabswitch and all Orchestral Percussion voices except Bells (unless on with an upper tabswitch voice) and Chimes. Speed is controlled by Repeat control in Effects Potentiometer Section. If one key is held, tone will alternate with same key one octave lower.

Note: Orchestral Percussion voices with long Preset Sustain are not compatible with this effect.

VIBRATO
Gives Vibrato effect to Upper/Lower Keyboard Tabswitch and Symphonic String voices.



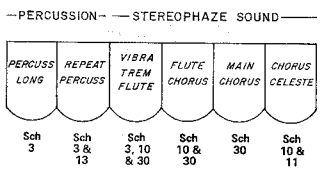
PERCUSS
Controls volume of Orchestral Percussion voices.

SUSTAIN
Controls the sustain length of Upper Keyboard Tabswitch and Symphonic String voices and some Orch. Percussion Presets when the Sustain Upper tabswitch is on.

REVERB
Enables the Reverb effect and controls the Reverb length for all sections of the organ.

REPEAT
Controls the Repeat speed when the Marimba or Repeat Percuss tabswitch is on.

INPUT
Controls the input signal level of the Right and Left Auxiliary Input Jacks.



PERCUSS LONG
Lengthens decay of Harmonic 4 and Harmonic 2-2/3 Orchestral Percussion voices. Keys must be held to hear effect.

REPEAT PERCUSSION
Causes Harmonic 4, Harmonic 2-2/3 and Bells in Orchestral Percussion section as well as Banjo and Mandolin voices in Orchestral Symphonizer section to key repeatedly at a rate controlled by the Repeat Slider Pot in effects control section. When selecting this tab all of the above buttons flash at the Repeat speed. The button selected lights steadily while the others continue to flash.

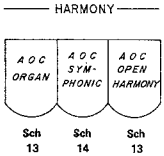
Note: Bells will have a Marimba repeat effect with this tab on. The Marimba Repeat tab will not effect bells unless on with an upper tabswitch voice.

VIBRA TREM FLUTE
Phase modulates all Flutes through the 2 channel chorus circuit on Schematic 10.

FLUTE CHORUS
Phase modulates all Flutes through the 2 channel chorus circuit on Schematic 10 and the 3 channel chorus circuit on Schematic 11.

MAIN CHORUS
Phase modulates all main R/S voices through the 3 channel chorus circuit on Schematic 11.

CHORUS CELESTE
Slows chorus effect when the Main or Flute Chorus tabs are on.



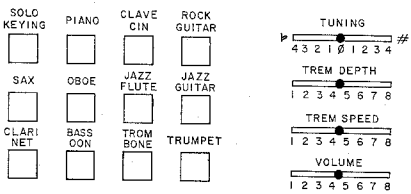
AOC ORGAN
Couples keys being played on Lower Keyboard to Upper Keyboard.
Gives the effect of playing full Upper Keyboard Chords with one finger. Lower Keyboard notes within three notes of the Upper Keyboard note played are not coupled. Effect can be used with all Upper Keyboard Tabswitch and Orch. Percussion voices except Chimes, Flute 5-1/3, Flute and Harmonic 2-2/3.

AOC SYMPHONIC
Same as AOC organ except effect is heard on Orchestral Symphonizer voices and the Wow & Orchestral voices of the Custom Symphonizer.

AOC OPEN HARMONY
Alters the coupling pattern when the AOC organ or AOC Symphonic Tabswitch is on. Lower Keyboard notes within five notes of the Upper Keyboard note being played are coupled to the Upper Keyboard an octave below the Upper Keyboard note being played.

SOLO SYMPHONIZER

Buttons: Schematic 18
LEDs: Schematic 17
Keying & Filtering: Schematics 26 & 27



The Solo Keying button may be on with any selected preset in this section. All other buttons in this section and the Solo Button in the Custom Symphonizer Section cancel each other. Selecting a preset in this section disables the glide circuits of the Main and Orchestral Symphonizer Oscillators.

SOLO KEYING

When playing with both hands on Upper Keyboard, prevents lead or solo note from being re-assigned to highest left-hand key when right hand is clear of keyboard. For example, if the Sax voice is on with Solo Keying off, and C1 and C4 are being held on upper keyboard, C4 plays. If C4 is released, C1 will play. With Solo Keying on, if C4 is released C1 will not play.

PIANO*

Sawtooth Audio with Percussive Envelope.

CLAVECIN*

Pulse width modulated Audio with Percussive Envelope.
* With Piano or Clavecin on, the Glide Switch (left side of Expression Shoe) becomes key up sustain length control switch.

ROCK GUITAR

Pulse width modulated Audio with Percussive Envelope.

SAX

Pulse width modulated Audio with Slow Attack Envelope.

OBOE

Pulse width modulated Audio with Slow Attack Envelope.

JAZZ FLUTE

Combination of 4' & 8' Audio with Noise Signal.

JAZZ GUITAR

Pulse audio with percussive Envelope. Filtered by voltage controlled filter.

CLARINET

Square wave 16' Audio with separate keyer.

BASSOON

Pulse width modulated Audio with Slow Attack Envelope.

TROMBONE

Pulse width modulated audio with Slow Attack Envelope. Filtered by voltage controlled filter.

TRUMPET

Pulse width modulated audio with Slow Attack Envelope. Filtered by voltage controlled filter.

CONTROLS

Affect all voices of the Solo Symphonizer Section and the Solo Voice of the Custom Symphonizer.

TUNING

Varies frequency of Solo Symphonizer oscillator.

TREM DEPTH, TREM SPEED

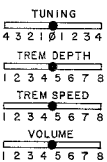
Controls speed and amplitude of Solo Tremolo oscillator. (When Piano or Clavecin are on the Tremolo Oscillator is disabled and these controls have no effect.)

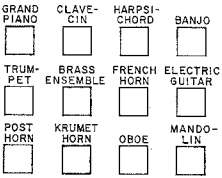
VOLUME

Controls amplitude of Solo Symphonizer Audio output.

Note: Only the highest upper keyboard note being held will sound the Solo voice.

ORCHESTRAL SYMPHONIZER





Buttons: Schematic 18
LEDs: Schematic 17
Keying & Filtering: Schematics 22-25

All buttons in this section and the Orchestral and Wow buttons of the Custom Symphonizer cancel each other.

GRAND PIANO*
Sawtooth Audio with Percussive Envelope and Chorus.

CLAVECIN*
Pulse Audio with Percussive Envelope and Chorus.

HARPSICHORD*
Pulse Audio with Strike Tone Audio, Percussive Envelope and Chorus.

* With Grand Piano, Clavecin or Harpsichord the Glide Switch (left side of Expression Shoe) becomes Key Up Sustain Length Control Switch. Also, the Main Glide circuit is disabled.

BANJO
Sawtooth Audio with detuning pulse and Percussive Envelope.

TRUMPET
Pulse Audio with Slow Attack Envelope. Filtered by voltage controlled filter.

BRASS ENSEMBLE
Pulse Audio with Slow Attack Envelope. Filtered by voltage controlled filter.

FRENCH HORN
Sawtooth Audio with Slow Attack Envelope and Deeper Chorus.

ELECTRIC GUITAR
Pulse Audio filtered by Electric Guitar filters. Percussive Envelope with Strike Tone Audio, Detuning Pulse and Chorus.

POST HORN
Pulse Audio with Slow Attack Envelope.

KRUMET HORN
Pulse Audio with Slow Attack Envelope.

OBOE
Pulse Audio with Slow Attack Envelope.

MANDOLIN
Pulse Audio with Percussive Envelope, Strike Tone Audio, Detuning Pulse and Chorus.

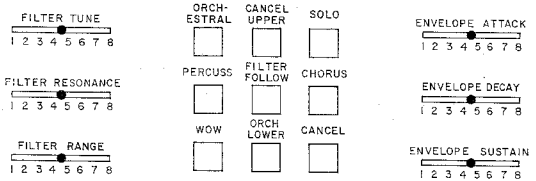
CONTROLS

TUNING
Varies frequency of Orchestral Symphonizer oscillator.

TREM DEPTH, TREM SPEED
Controls speed and amplitude of Orchestral Tremolo oscillator. (When Piano, Clavecin, Harpsichord, Banjo or Mandolin on the tremolo oscillator is disabled and these controls have no effect.)

VOLUME
Controls amplitude of Orchestral Symphonizer Audio output.

CUSTOM SYMPHONIZER



Buttons: Schematic 18
LEDs: Schematic 17

All buttons in this section are additive except Wow & Orchestral.

ORCHESTRAL
Can be considered an additional Orchestral Symphonizer Voice. (See Orchestral Symphonizer spec sheet.) Uses pulse audio that is filtered by the voltage controlled filter on Schematic 25. All controls of Custom Symphonizer and Orchestral Symphonizer will effect this voice.

WOW
Same as Orchestral voice except Custom Symphonizer Controls do not effect this voice.

SOLO
Can be considered an additional Solo Symphonizer voice. (See Solo Symphonizer spec sheet.) Uses pulse audio that is filtered by the voltage controlled filter on Schematic 27. All controls of Custom Symphonizer and Solo Symphonizer will effect this voice.

CANCEL UPPER
Cancels Upper Keyboard tabswitch voices if any Orchestral, Solo or Custom Symphonizer voice is on, or any Orchestral Percussion voice except Harmonic 4 or 2-2/3.

Note: If Orchestral Golden Harp is being played with no Orchestral Percussion, Solo or Custom Symphonizer voice on, pressing this button will not cancel upper tabswitch voices.

PERCUSS
Gives a Percussive Attack to the Orchestral or Solo voices of this section.

FILTER FOLLOW
When on with either the Solo or Orchestral voice, causes the tuning of the VCO filters (Schematic 25 for Orchestral and Schematic 27 for Solo) to follow the highest keyboard note being played.

CHORUS
Directs the Orchestral, Wow or Solo voice through the three channel chorus circuit.

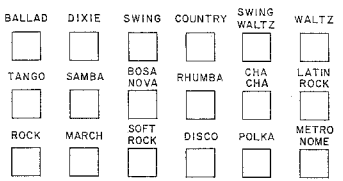
ORCH TO LOWER
Allows the Orchestral Symphonizer voices to be played from the Lower Keyboard.

CANCEL
Cancels all buttons of the Orchestral, Custom and Solo Symphonizers. This button does not light when pressed.

CONTROLS

FILTER TUNE, FILTER RESONANCE, FILTER RANGE, ENVELOPE ATTACK, ENVELOPE DECAY, ENVELOPE SUSTAIN
The above controls effect the tuning envelope, used to drive the VCO filters on Schematic 25 for the Orchestral voice and Schematic 27 for the Solo Voice. These controls only effect the Orchestral and Solo voice of the Custom Symphonizer.

DIGITAL STEREO RHYTHM



Buttons: Schematic 18
LEDs: Schematic 16
Filtering: Schematics 28 & 29

All buttons in this section cancel each other. (See Rhythm Pattern Charts for specific instrumentation.)

Selecting an Orchestration Plus style causes one to four rhythm buttons to flash (see chart below), indicating recommended rhythm patterns for that style. Once a rhythm pattern is selected, the light for that rhythm lights steadily leaving the other recommended patterns flashing.

If the Orchestration Plus style is changed after selecting a rhythm pattern, the preferred rhythm pattern for the new style will automatically be selected.

Exception

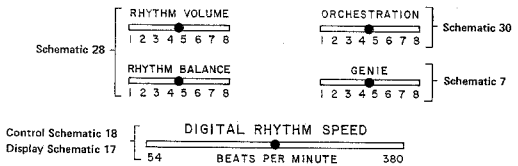
Once the Waltz or Swing Waltz rhythm is selected, no subsequent Orchestration Plus style selections will cancel that rhythm pattern, but will merely flash recommended patterns.

ORCH. PLUS RHYTHM SELECTION GUIDE

RHYTHM PUSHBUTTONS

ORCH. PLUS PATTERN	ROW 1						ROW 2						ROW 3					
	Ballad	Dixie	Swing	Country	Swing Waltz	Waltz	Tango	Samba	Bosa Nova	Rhumba	Cha Cha	Latin Rock	Rock	March	Soft Rock	Disco	Polka	Metronome
Big Band		*	X	X					X	X			*					
Contempo													*				*	
Polka																	*	
Country		*			X													
Jazz Guitar	X	X	*	X														
Rock													*		X	X		
Baroque									X				*		X			
Blue Grass		*		X														
Rhythm Guitar		*	X	X														
Disco																*		
Waltz					*	X												
Latin								X	*		X				X			

* Preferred Rhythm Pattern



RHYTHM VOLUME
Controls amplitude of Rhythm Audio output.

ORCHESTRATION
Controls amplitude of Orchestration Plus Audio output.

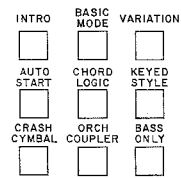
RHYTHM BALANCE
Controls amplitude of Right and Left Channel Rhythm voices.

GENIE
Controls volume of Lower Keyboard Piano, Guitar & Banjo voices.

DIGITAL RHYTHM SPEED
This is a 24 position slider switch which determines speed of Rhythm and Orchestration Plus patterns. The beats per minute are shown on the Digital Rhythm Display.

POSITION	DISPLAY	POSITION	DISPLAY
1	54	13	150
2	59	14	163
3	64	15	178
4	70	16	193
5	76	17	210
6	83	18	229
7	90	19	250
8	98	20	271
9	107	21	295
10	116	22	321
11	127	23	350
12	138	24	380

PERFORMANCE EFFECTS



Buttons: Schematic 18
LEDs: Schematic 16

INTRO (DOWNBEAT)
Flashes red at downbeat when a Rhythm pattern is selected. When pressed, Rhythm pattern changes to Intro pattern and LED lights green for the duration of the Intro pattern, alternating red at downbeat. If an Orchestration Plus style is being played with Rhythm, only the bass portion of the Orchestration Plus style is heard during Intro. Selecting Intro with Rhythm off, has no effect on Orchestration Plus, but the Intro LED will light green until a Rhythm is selected and the Intro pattern plays.

VARIATION*
Alters Orchestration Plus styles by adding, subtracting or changing instruments within patterns. (See Orchestration Plus Style Description Chart.)

BASIC MODE*
Can be considered a second Orchestration Plus variation but only effects some styles. (See Orchestration Plus Style Description Chart.)

* Basic Mode and Variation cancel each other.

AUTO START
When selected, Rhythm and/or Orchestration Plus must be started by depressing a lower keyboard key. Upon key release, pattern will complete measure then stop.

CHORD LOGIC
When selected, chord changes for the Orchestration Plus will occur only when a new key-down is detected and not when keys are released. For example, assume a C minor chord (C1 & D#1) is being held with Chord Logic on. If the D#1 (minor) key is released the Orchestration Plus will continue to play a C minor chord. If Chord Logic was not on, a C major chord would play upon release of the D#1 key.

KEYED STYLE
Only Bass portion of Orchestration Plus style is heard until Lower Keyboard keys are pressed.

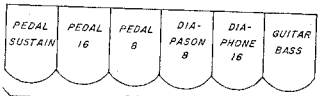
CRASH CYMBAL
Manually keys the crash cymbal when pressed. Does not light.

ORCH. COUPLER
With the Orch. Coupler on, it is possible to replace instruments in the Orch. Plus styles with any Orchestral Symphonizer voice selected. For example, if Bluegrass style is selected the Banjo is replaced by the selected Orchestral Symphonizer voice. Orchestral Symphonizer controls are ineffective when using this coupler, because the equivalent Orchestral Symphonizer voice is actually generated by the Orchestration Plus circuitry. Also the bass portion of the Orch. Plus style may be replaced at this time by selecting one of the Symphonic Bass pushbuttons.

BASS ONLY
Only bass portion of Orchestration Plus is heard.

Note: This button lights when Bass Plus tabswitch is on.

BASS

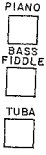


Schematic 12

Pedal Tabswitch Voices are inoperative if an Orchestration Plus style is being used.

The Audio signal for these voices is produced by the Programmable Oscillator Peripheral IC29 on Orch. Plus Board 25B. Filtering and switching for these voices is shown on Schematic 12. These voices can be played from Lower Keyboard if the Genie Bass Tabswitch is on.

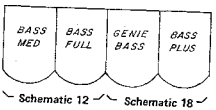
SYMPHONIC BASS



Buttons: Schematic 18
LEDs: Schematic 16
Filtering: Voice Channel 6 of Orch. Plus Schematic 21

Buttons in this section cancel each other and are inoperative if an Orchestration Plus style is being used.

These voices can replace the bass portion of the Orchestration Plus styles when the Orch. Coupler button in the Performance Effects section is on. Voices can also play on Lower Keyboard if the Genie Bass tab is on.

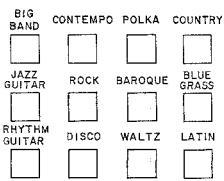


Schematic 12 Schematic 18

BASS MED, BASS FULL
Controls volume of Genie Bass, Orchestration Plus Bass and Pedals.

GENIE BASS
Allows the Pedal Tabswitch voices or the Symphonic Bass pushbutton voices to play on the Lower Keyboard. If a Rhythm is on the bass voice will alternate in a high low pattern. Playing a pedal will cancel Lower Keyboard bass.

BASS PLUS
Transfers Orchestration Plus control to Pedal switches and only Bass portion of Orchestration Plus is heard. Also causes Bass Only button in Performance Effect Section to light.



Buttons:	**Schematic 18**
LEDs:	**Schematic 16**
Filtering & Keying:	**Schematics 19, 20 & 21**

All buttons in this section cancel each other. Instruments and patterns vary for each style, depending on lower keyboard chord played and variation or basic mode selection. (See Scale and Chord Structure Chart in Chart section of manual.) If no chord has been selected before selecting an Orch. Plus style, a C major chord will play.

BIG BAND
A standard Dance Band - 5 Brass, 5 Saxes and a String Bass play accompaniment in the style of a Dance Band.

CONTEMPORARY
An Electric Guitar, Cello and Electric Bass play a contemporary soft rock style accompaniment.

POLKA
Trumpets, Trombones, Clarinets, Musette Accordion and Tuba play a polka accompaniment.

COUNTRY
A Steel Guitar, Piano, Acoustic Rhythm Guitar and String Bass play a country style accompaniment.

JAZZ GUITAR
An Electric Guitar and String Bass play a Jazz style accompaniment.

ROCK
An Electric Guitar and Electric Bass play a rock style accompaniment.

BAROQUE
A Harpsichord and Electric Bass play a three-part counterpoint accompaniment.

BLUEGRASS
A five-string Banjo, "Hoedown" Fiddle, Acoustic Rhythm Guitar and String Bass play a Bluegrass accompaniment.

RHYTHM GUITAR
An Acoustic Guitar and String Bass play straight rhythm accompaniment.

DISCO
A Clavinet, Brass Section and Electric Bass play a disco style accompaniment.

WALTZ
A full String Section and String Bass play a melodic accompaniment or an Acoustic Guitar and Bass play rhythm accompaniment.

LATIN
An Electric Guitar and String Bass play a Bosa Nova style accompaniment.

For more information on Orch. Plus styles, see "Description of Orchestration Styles Chart" and "Orchestration Plus Voice Channel Chart" in Chart Section of manual.

GENERAL FEATURES

HEADPHONE - Schematic 31
Stereo Headphone Jack does not cancel speakers.

CANCEL SPEAKERS - Schematic 31
Mechanically latched pushbutton switch (Red Lens - Red LED) which cancels all internal speakers when lighted.

RIGHT- and LEFT-IN - Schematic 30
Stereo input to organ used for recorder playback. Input level controlled by input slider pot in Effects Controls section.

RIGHT- and LEFT-OUT - Schematic 31
Stereo output from organ used for input to recorder microphone jack.

CANCEL ACCOMP. - Switch, Schematic 18; Bulb, Schematic 16
Always lighted, cancels Orchestration Plus buttons, Rhythm buttons and any Magic Chord or Magic Memory notes that are playing.

SPOT LIGHTS, TAB LIGHT, PANEL LIGHTS - Schematic 32
Intensity controlled by three 3-position toggle switches.

PHOTOELECTRIC EXPRESSION PEDAL - Schematic 30
Controls volume of all organ channels.

POWER ON/OFF - Schematic 32
Three to four-second delay before speaker relay is activated.

IMPORTANT INFORMATION

SCHEMATIC DRAWINGS, PRINTED WIRING BOARDS

1) The numbering on each printed wiring board begins with Q1, IC1 and D1.
2) Board locations are clearly shown in large letters.
3) Two or more components with the same reference number may be drawn on the same schematic.
4) When components from two or more printed wiring boards are drawn on the same schematic, shaded areas will separate the components and their location will be clearly identified.
5) "S" numbers refer to socket numbers which are screened on PC boards. Pins in sockets are numbered from left to right or bottom to top as board is viewed in organ.
6) All tabswitches, pushbutton switches and keyswitches are shown "off" unless otherwise specified.

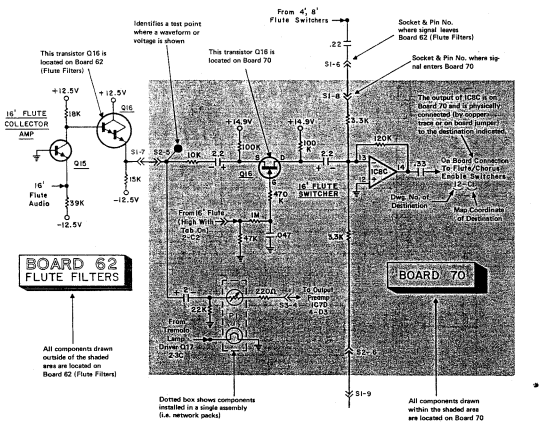
TEST EQUIPMENT

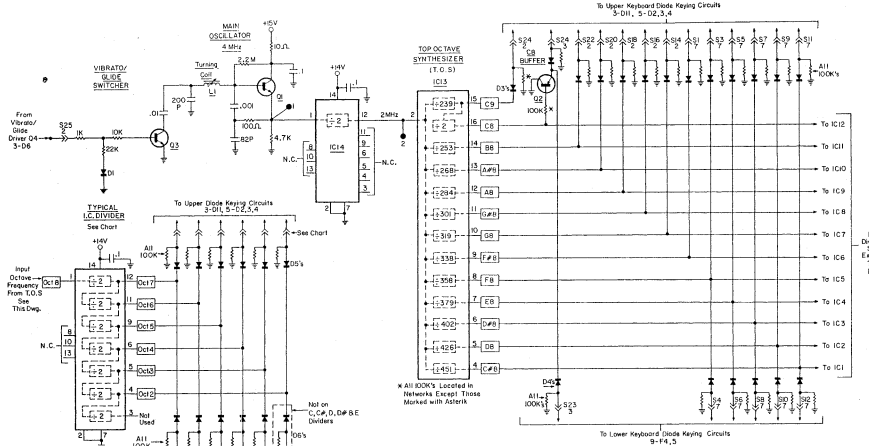
1) All voltages are measured with a Simpson 260 VOM to ground reference.
2) Oscilloscope waveforms are approximations.
3) Unless specified, measurements are made with keyswitches, tabswitches and pushbutton switches in the "off" position and controls at minimum.

NOTE: Actual voltages and waveshapes will vary depending on the accuracy of your test equipment, loading, component tolerances, power supply voltages and other variables.

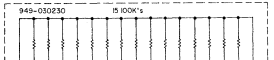
COMPONENTS

1) Resistors have 5 or 10% tolerances and are rated at 1/4 or 1/2 watt unless otherwise specified.
2) Capacitor values are in microfarads (uf) unless otherwise specified.
3) All components are located on indicated boards unless specified.
4) See Parts List for component part numbers.
5) ✠ Denotes factory-tailored component.
6) Resistors with "R" numbers and capacitors with "C" numbers are located in networks or listed in charts as indicated on individual drawings.





BOARD 20
MAIN
TONE GENERATOR



NETWORK DETAIL

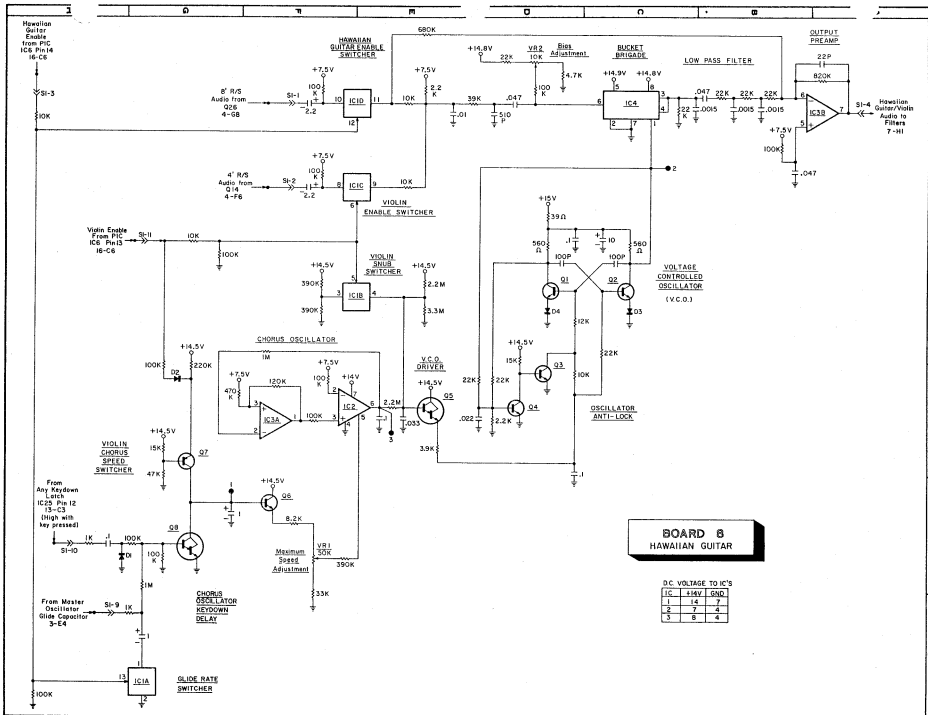
DIVIDER OUTPUT SOCKET CHART

Note	OCTAVE FREQUENCY					
	7	6	5	4	3	2
C	S24-4	S24-5	S24-6	S24-9	S24-8	S24-7
	S23-9	S23-8	S23-7	S23-4	S23-5	——
C#	SII-6	SII-5	SII-4	SII-1	SII-2	SII-3
	SI2-1	SI2-2	SI2-3	SI2-6	SI2-5	——
D	S9-6	S9-5	S9-4	S9-1	S9-2	S9-3
	SI0-1	SI0-2	SI0-3	SI0-6	SI0-5	——
D#	S7-6	S7-5	S7-4	S7-1	S7-2	S7-3
	S8-1	S8-2	S8-3	S8-6	S8-5	——
E	S5-6	S5-5	S5-4	S5-1	S5-2	S5-3
	S6-1	S6-2	S6-3	S6-6	S6-5	——
F	S3-6	S3-5	S3-4	S3-1	S3-2	S3-3
	S4-1	S4-2	S4-3	S4-6	S4-5	S4-4

Note	OCTAVE FREQUENCY					
	7	6	5	4	3	2
F#	SI-6	SI-5	SI-4	SI-1	SI-2	SI-3
	S2-1	S2-2	S2-3	S2-6	S2-5	S2-4
G	SI4-3	SI4-4	SI4-5	SI4-8	SI4-7	SI4-6
	SI3-8	SI3-7	SI3-6	SI3-3	SI3-4	SI3-5
G#	SI6-3	SI6-4	SI6-5	SI6-8	SI6-7	SI6-6
	SI5-8	SI5-7	SI5-6	SI5-3	SI5-4	SI5-5
A	SI8-3	SI8-4	SI8-5	SI8-8	SI8-7	SI8-6
	SI7-8	SI7-7	SI7-6	SI7-3	SI7-4	SI7-5
A#	S20-3	S20-4	S20-5	S20-8	S20-7	S20-6
	SI9-8	SI9-7	SI9-6	SI9-3	SI9-4	SI9-5
B	S22-3	S22-4	S22-5	S22-8	S22-7	S22-6
	S21-8	S21-7	S21-6	S21-3	S21-4	S21-5

Note	7	
C	S24-4	Socket B Pin No. For C7 Upper Keyb. Output
	S23-9	Socket B Pin No. For C7 Lower Keyb. Output

C7 Chart Example



D.C. VOLTAGE TO IC'S

IC	+14V	GND
1	14	7
2	7	4
3	8	4

UPPER KEYBOARD & DC CONTROL

Decoder IC	Keyb Ref	Pin Keyed No.	Diode Sw. No.	Keyer				Socket Designation							
				A	B	C	D	E	F	G	H	J	K	L	M
IC1	G1	21	49	110	S5-2	S1-2	S6-1		S1-H		S10-6		S9-1		S11-1
	G#1	22	48	109	S5-3	S1-3	S6-2		S1-J		S10-5		S9-2		S11-2
	A1	23	47	108	S5-4	S1-4	S6-3		S1-K		S10-4		S9-3		S11-3
	A#1	24	46	107	S4-1	S1-5	S6-4		S1-L		S10-3		S9-4		S11-4
	B1	25	45	106	S4-2	S1-6	S6-5		S1-M		S10-2		S9-5		S11-5
	C1	26	44	105	S4-3	S1-7	S6-6	S5-1	S1-N	S6-1	S10-1	S10-13	S9-6	S9-13	S11-6
	C#1	27	43	104	S4-4	S1-8	S6-7	S5-2	S1-P	S6-2	S10-12	S10-12	S9-7	S9-12	S11-7
	D1	28	42	103	S4-5	S1-9	S6-8		S1-R		S10-11		S9-8		S11-8
	D#1	29	41	102	S4-6	S1-10	S6-9		S1-S		S10-10		S9-9		S11-9
	E1	30	40	101	S4-7	S1-11	S6-10		S1-T		S10-9		S9-10		S11-10
	F1	31	39	100	S4-8	S1-12	S6-11		S1-U		S10-8		S9-11		S11-11
	B1	32	38	99	S3-1	S1-13	S6-12		S1-V		S10-7		S9-12		S11-12
	C2	33	37	98	S3-2	S1-14	S6-13		S1-W		S10-6		S9-13		S11-13
	C#2	34	36	97	S3-3	S1-15	S7-1		S1-X		S10-5		S9-14		S11-14
	D2	35	35	96	S3-4	S1-16	S7-2	S5-3	S1-Y	S6-3	S10-4	S10-11	S9-15	S9-11	S11-15
	D#2	36	34	95	S3-5	S1-17	S7-3	S5-4	S1-Z	S6-4	S10-3	S10-10	S9-16	S9-10	S11-16
	E2	4	33	94	S3-6	S1-18	S7-4		S1-a		S10-2		S9-17		S11-17
	F2	5	32	93	S3-7	S1-19	S7-5		S1-b		S10-1		S9-18		S11-18
	F#2	6	31	92	S3-8	S1-20	S7-6		S1-c		S10-13		S9-19		S11-19
	G2	7	30	91	S2-1	S1-21	S7-7		S1-d		S10-12		S9-20		S11-20
	G#2	8	29	90	S2-2	S1-22	S7-8	S5-5	S1-e	S6-5	S10-11	S10-9	S9-21	S9-9	S11-21
	A2	9	28	89	S2-4	S2-1	S7-9	S5-6	S1-f	S6-6	S10-10	S10-8	S9-22	S9-8	S11-22
	A#2	10	27	88	S2-5	S2-2	S7-10		S1-g		S10-9		S9-23		S11-23
	B2	11	26	87	S2-6	S2-3	S7-11		S1-h		S10-8		S9-24		S11-24

BOARD 24 — BOARD 22

BOARD 18
MAIN D.C. CONTROL

LOW FREQUENCY FLUTE LAMP DRIVER

TREMOLO DRIVER

To Low Frequency Flute Photocell P1 4-5T

From High Speed Channel Chorus Connector IC2 Pin 1 10-C5

BOARD 40
Vibes Tine, Flute 4 of 5 Contact

10-J4 10-J5 10-J6

KEYDOWN PULSE DRIVER

VIBRATO OSCILLATOR

Tremolo Enable from PIC IC6 Pin 11 16-A2

KEYDOWN PULSE ENABLERS

VIBES, VIBRA HARP LAMP DRIVER

To Vibes, Vibra Harp Photocell P2 4-H2

VIBRATO DELAY TRIGGER

SWITCHER

Vibrato Delay Enable from PIC IC6 Pin 12 16-A2

Vibrato Depth Adjust

Vibrato Speed Adjust

VIBRATO CANCEL SWITCHER

From Keydown Pulse Enable IC6 Pin 25 16-H2

BOARD 41

VIBRATO/GLIDE DRIVER

To Vibrato/Glide Switcher G 1-H2

EXPRESSION SHOE

Switch Contacts Closed When Pedal Is Forward

From PIC IC6 Pin 34 High Solo Sump Del 17-H8

To Orch Sump DC Control 13-C2

To Monophase Guitar Glide Capacitor D-H6

Glide/Vibrato Kill Disable Switcher

From Any Keydown Latch IC15 Pin 12 19-C3

UPPER SYMP. STRING MODULATOR DRIVER

KEYDOWN DISCHARGE SWITCHER

SYMP. STRING SLOW ATTACK ENABLE SWITCHER

BOARD 41
Upper String Vibrato Attack Control

BOARD 36
Upper String Vibrato Control

To Upper Symp String Modulator IC15 Pin 5 6-B4

From Upper Symp String "Out" Detector Q5 Low on! 6-C3

UPPER SYMP. STRING "ON" SWITCHER

* See table below to determine input logic levels for selected expression preset

Selected Preset	Input Pulse						
	A	B	C	D	E	F	G
Harmonic 4	1	1	1	0	1	1	1
Harmonic 3-2/3	1	1	0	0	1	1	0
Vibes	1	1	1	1	0	1	0
Vibra Harp	0	1	1	1	0	1	0
Bells	1	1	1	1	0	1	0
Chimes	1	1	0	1	1	0	0
Accordion	1	1	0	1	0	1	1
Violin	1	1	0	1	0	1	0
Hawaiian Guitar	1	1	0	1	0	1	1

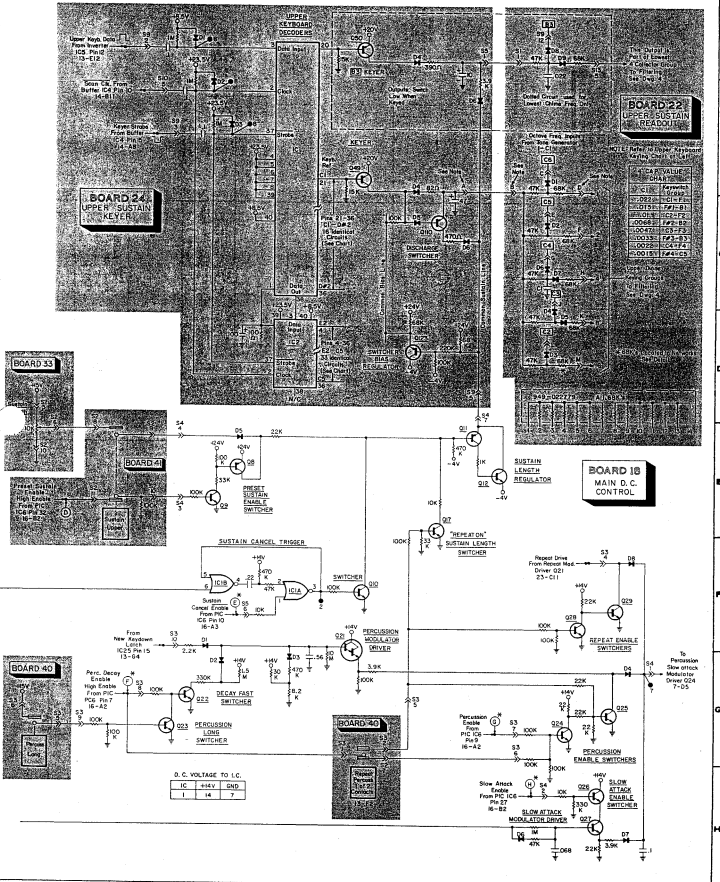
Points A & E are Low Enable

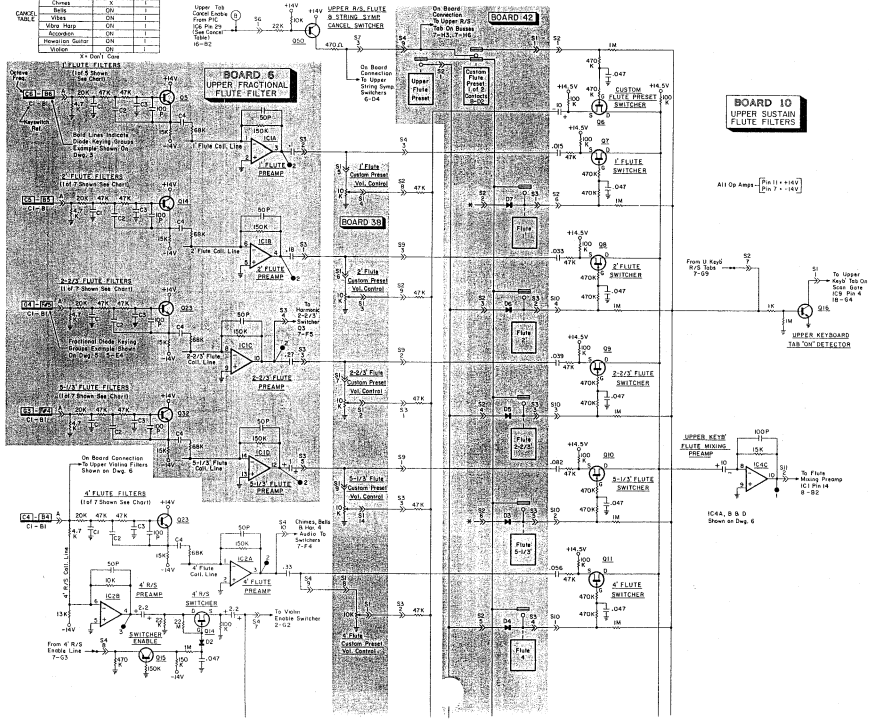
Continued from above

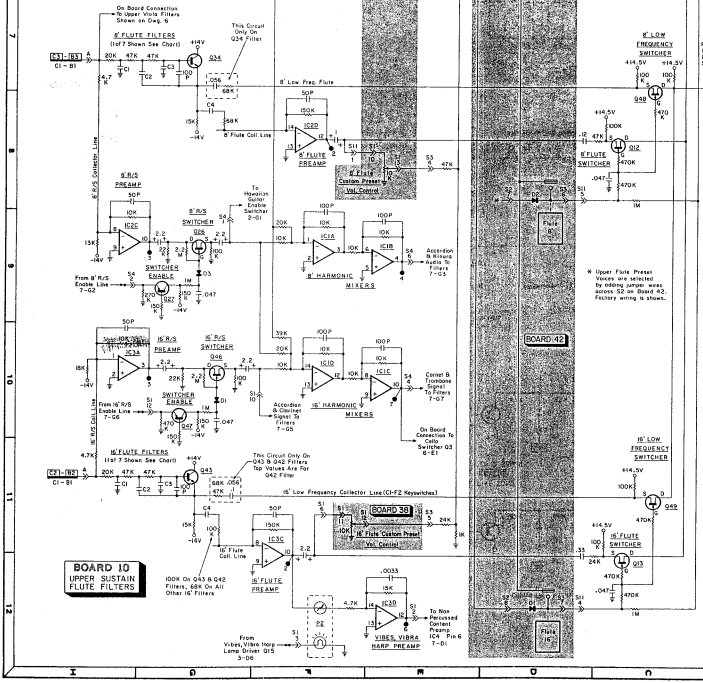
UPPER KEYBOARD KEYING CHART (Cont'd)

Decoder IC	Keyb Ref	Pin No.	Keyed	Diode Sw. No.	Keyer				Socket Designation							
					A	B	C	D	E	F	G	H	J	K	L	M
IC2	C3	12	25	86	S2-13	S1-23	S8-1			S7-1		S6-1		S11-1		S10-1
	C#3	13	24	85	S1-24	S2-18	S7-2			S7-2		S6-2		S11-2		S10-2
	D3	14	23	84	S1-8	S2-17	S8-2			S7-3	S16-1	S6-3	S14-1	S11-3	S14-1	S10-3
	D#3	15	22	83	S1-7	S2-16	S8-3			S7-4	5	S6-4	7	S11-4	7	S10-4
	E3	16	21	82	S1-6	S2-15	S8-4			S7-5		S6-5		S11-5		S10-5
	F3	17	20	81	S1-5	S2-14	S8-5			S7-6		S6-6		S11-6		S10-6
	F#3	18	19	80	S1-3	S1-2	S8-6			S7-7		S6-7		S11-7		S10-7
	G3	19	18	79	S1-2	S1-1	S8-7			S7-8		S6-8		S11-8		S10-8
	G#3	20	17	78	S1-1	S1-3	S8-8			S7-9		S6-9		S11-9		S10-9
	A3	21	16	77	S6-1	S2-4	S8-9	S5-5	S6-8	S7-10	S16-2	S6-10	S14-2	S11-10	S14-2	S10-10
	A#3	22	15	76	S6-2	S3-1	S8-10			S7-11	6	S6-11	8	S11-11	8	S10-11
	B3	23	14	75	S6-3	S3-2	S8-11			S7-12		S6-12		S11-12		S10-12
	C4	24	13	74	S6-4	S4-1	S8-12			S8-1		S7-1		S6-1		S11-1
	C#4	25	12	73	S6-5	S4-2	S8-13			S8-2		S7-2		S6-2		S11-2
	D4	26	11	72	S6-6	S4-3	S8-14			S8-3	S16-3	S7-3	S14-3	S6-3	S14-3	S11-3
	D#4	27	10	71	S6-7	S4-4	S8-15			S8-4	7	S7-4	9	S6-4	9	S11-4
	E4	28	9	70	S6-8	S4-5	S8-16			S8-5		S7-5		S6-5		S11-5
	F4	29	8	69	S6-9	S4-7	S9-1			S8-6		S7-6		S6-6		S11-6
	F#4	30	7	68	S7-1	S4-6	S9-2			S8-7		S7-7		S6-7		S11-7
	G4	31	6	67	S7-2	S4-8	S9-3			S8-8		S7-8		S6-8		S11-8
	G#4	32	5	66	S7-3	S4-9	S9-4			S8-9		S7-9		S6-9		S11-9
	A4	33	4	65	S7-4	S4-10	S9-5	S5-6	S6-9	S7-10	S16-4	S7-10	S14-4	S6-10	S14-4	S11-10
	A#4	34	3	64	S7-5	S4-11	S9-6			S7-11	8	S7-11	10	S6-11	10	S11-11
	B4	35	2	63	S7-6	S4-12	S9-7			S7-12		S7-12		S6-12		S11-12
	C5	36	1	62	S7-7	S4-13	S9-8			S8-10		S8-1		S7-1		S6-1

BOARD 24 — BOARD 22

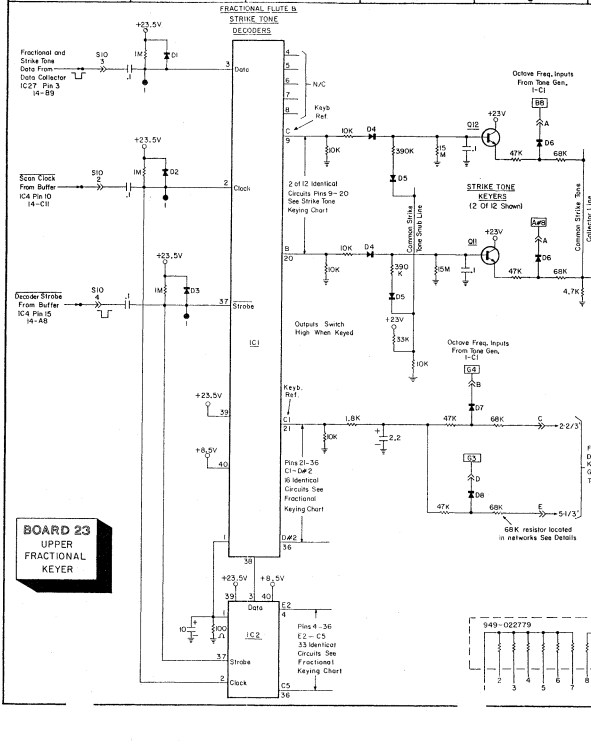

BOARD 24
UPPER SUSTAIN KEYER
BOARD 22
UPPER SUSTAIN READOUT
BOARD 33
BOARD 41
BOARD 40
BOARD 18
MAIN D.C. CONTROL
SUSTAIN CANCEL TRIGGER
SUSTAIN LENGTH REGULATOR
"REPEAT ON" SUSTAIN LENGTH SWITCHER
REPEAT ENABLE SWITCHERS
PERCUSSION MODULATOR DRIVER
DECAY FAST SWITCHER
PERCUSSION LONG SWITCHER
PERCUSSION ENABLE SWITCHERS
SLOW ATTACK ENABLE SWITCHER
SLOW ATTACK MODULATION DRIVER
PRESET SUSTAIN ENABLE SWITCHER
D.C. VOLTAGE TO I.C.
IC | +44V | GND
1 | 14 | 7


CANCEL TABLE
Selected Voice ON | Cancel Upper | Input B
Chimes | X | 1
Bells | ON | 1
Vibes | ON | 1
Vibra Harp | ON | 1
Accordion | ON | 1
Hawaiian Guitar | ON | 1
Violion | ON | 1
X= Don't Care
BOARD 6
UPPER FRACTIONAL FLUTE FILTER
BOARD 42
BOARD 10
UPPER SUSTAIN FLUTE FILTERS
BOARD 38
1' FLUTE FILTERS
2' FLUTE FILTERS
3-2/3' FLUTE FILTERS
2-2/3' FLUTE FILTERS
5-1/3' FLUTE FILTERS
4' FLUTE FILTERS
1' FLUTE PREAMP
2' FLUTE PREAMP
2-2/3' FLUTE PREAMP
5-1/3' FLUTE PREAMP
4' FLUTE PREAMP
4' R/S PREAMP
1' FLUTE SWITCHER
2' FLUTE SWITCHER
2-2/3' FLUTE SWITCHER
5-1/3' FLUTE SWITCHER
4' FLUTE SWITCHER
CUSTOM FLUTE PRESET SWITCHER
UPPER KEYB' FLUTE MIXING PREAMP
UPPER KEYBOARD TAB 'ON' DETECTOR
4' R/S SWITCHER
SWITCHER ENABLE
1' Flute Custom Preset Vol. Control
2' Flute Custom Preset Vol. Control
2-2/3' Flute Custom Preset Vol. Control
5-1/3' Flute Custom Preset Vol. Control
4' Flute Custom Preset Vol. Control
Flute 1
Flute 2
Flute 2-2/3
Flute 5-1/3
Flute 4
UPPER R/S, FLUTE & STRING SYMP. CANCEL SWITCHER
On Board Connection To Upper R/S Tab On Buses 7-H3, 7-H6
On Board Connection To Upper R/S, Flute & String Symp. Switchers 6-D4
On Board Connection To Upper Violins Filters Shown on Dwg. 6
All Op Amps: Pin 11 = +14V, Pin 7 = -14V
IC4A, B & D Shown on Dwg. 6
Chimes, Bells & Hpc. 6 Audio To Switchers 7-F4
To Violin Enable Switcher 2-G2
From 4' R/S Enable Line 7-G3
From U Key6 R/S Tab 7-G9
To Upper Key6 Tab On Scan Gate ICB Pin 4 B-G4
To Flute Mixing Preamp IC1 Pin 14 B-B2
Optional Free Reposition Ref.
Solid Lines Indicate Diode Keying Previous Example Shown On Dwg. 3
Positional Diode Keying Previous Example Shown On Dwg. 3 & 5-E4
Flute Coil Line
2' Flute Coil Line
2-2/3' Flute Coil Line
5-1/3' Flute Coil Line
4' Flute Coil Line
4' R/S Coil Line



UPPER KEYBOARD FLUTE FILTER CHART

Footage	Keyb'd Group	Octave Freq.	Socket Pin Input	Socket Trans-istor	C1	C2	C3	C4
1' Board 6	C1-B1	C5-B5	S5-5	Q5	.0056	.022	120P	.0082
	C2-F2	C6-F6	S6-6	Q4	.0039	.015	82P	.0039
	F#2-B2	F#7-B7	S5-3	Q3	.0027	.01	56P	.0027
	C3-F3	C7-F8	S5-2	Q2	.0018	.0068	39P	.0022
	F#3-C4	F#8-C9						
	F#4-C5	F#9-C9	S5-1	Q1	.0012	.0047	33P	.0015
2' Board 6	C1-B1	C5-B5	S4-7	Q14	.01	.039	240P	.015
	C2-F2	C6-F6	S4-6	Q13	.0082	.027	150P	.0082
	F#2-B2	F#6-B6	S4-5	Q12	.0056	.022	120P	.0056
	C3-F3	C7-F7	S4-4	Q11	.0039	.015	82P	.0039
	F#3-B3	F#7-B7	S4-3	Q10	.0027	.01	56P	.0027
	C4-F4	C8-F8	S4-2	Q9	.0018	.0068	39P	.0022
	F#4-C5	F#8-C9	S4-1	Q8	.0012	.0047	33P	.0015
2-2/3' Board 6	C1-B1	C4-F#5	S1-7	Q23	.015	.056	330P	.022
	C2-F2	C5-C6	S1-6	Q22	.01	.039	220P	.01
	F#2-B2	F#5-F#6	S1-5	Q21	.0068	.027	150P	.0082
	C3-F3	C6-C7	S1-4	Q20	.0047	.018	100P	.0056
	F#3-B3	F#7-F#7	S1-3	Q19	.0033	.015	82P	.0039
	C4-F4	C7-C8	S1-2	Q18	.0027	.01	56P	.0027
	F#4-C5	F#8-C8	S1-1	Q17	.0018	.0068	39P	.0018
5-1/3' Board 6	C1-B1	G1-B#1	S2-7	Q12	.027	.12	620P	.047
	C2-F2	G#1-C5	S2-6	Q13	.022	.082	470P	.022
	F#2-B2	F#5-F#5	S2-5	Q30	.015	.056	330P	.015
	C3-F3	D1-G#4	S2-4	Q29	.01	.039	220P	.01
	F#3-B3	F#5-F#6	S2-3	Q28	.0068	.027	150P	.0082
	C4-F4	G6-C7	S2-2	Q27	.0047	.018	120P	.0056
	F#4-C5	F#7-D7	S2-1	Q26	.0033	.012	68P	.0039
4' Board 10	C1-B1	C4-B4	S6-3	Q23	.022	.082	470P	.033
	C2-F2	C5-F5	S5-4	Q22	.015	.056	330P	.015
	F#2-B2	F#5-B5	S5-5	Q21	.01	.039	240P	.012
	C3-F3	C6-C7	S5-6	Q20	.0068	.027	150P	.0082
	F#3-B3	F#6-B6	S5-7	Q19	.0056	.022	120P	.0056
	C4-F4	C7-F7	S5-8	Q18	.0039	.015	82P	.0039
	F#4-C5	F#7-C8	S5-9	Q17	.0027	.01	56P	.0027
8' Board 10	C1-B1	C3-B3	S12-3	Q34	.039	.18	.001	.068
	C2-F2	C4-F4	S12-4	Q33	.033	.12	680P	.033
	F#2-B2	F#4-B4	S12-5	Q32	.022	.082	470P	.022
	C3-F3	C5-F5	S12-6	Q31	.015	.056	330P	.018
	F#3-B3	F#5-B5	S12-7	Q30	.01	.039	240P	.012
	C4-F4	C6-F6	S12-8	Q29	.0082	.027	150P	.0082
	F#4-C5	F#6-C7	S12-9	Q28	.0047	.018	120P	.0056
16' Board 10	C1-B1	C2-B2	S13-3	Q43	.082	.33	.0018	.12
	C2-F2	C3-F3	S13-4	Q42	.056	.22	.0012	.068
	F#2-B2	F#3-B3	S13-5	Q41	.039	.18	.001	.047
	C3-F3	C4-F4	S13-6	Q40	.033	.12	680P	.033
	F#3-B3	F#4-B4	S13-7	Q39	.022	.082	470P	.022
	C4-F4	C5-F5	S13-8	Q38	.015	.056	330P	.018
	F#4-C5	F#5-C6	S13-9	Q37	.01	.039	220P	.012



Note: Strike tone used only with Bells or Vibes voices on.

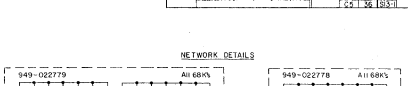
STRIKE TONE KEYING CHART

Decoder IC1 Pin No.	Keyb. Ref.	Keyer Q No.	Octave Freq. Keyed	Socket A
9	C	Q12	B8	S14-1
10	C#	Q1	C8	S12-2
11	D	Q2	C#8	S12-1
12	D#	Q3	D8	S13-6
13	E	Q4	D#8	S13-5
14	F	Q5	E8	S13-4
15	F#	Q6	F8	S13-3
16	G	Q7	F#8	S13-2
17	G#	Q8	G8	S13-1
18	A	Q9	G#8	S14-4
19	A#	Q10	A8	S14-3
20	B	Q11	A#8	S14-2

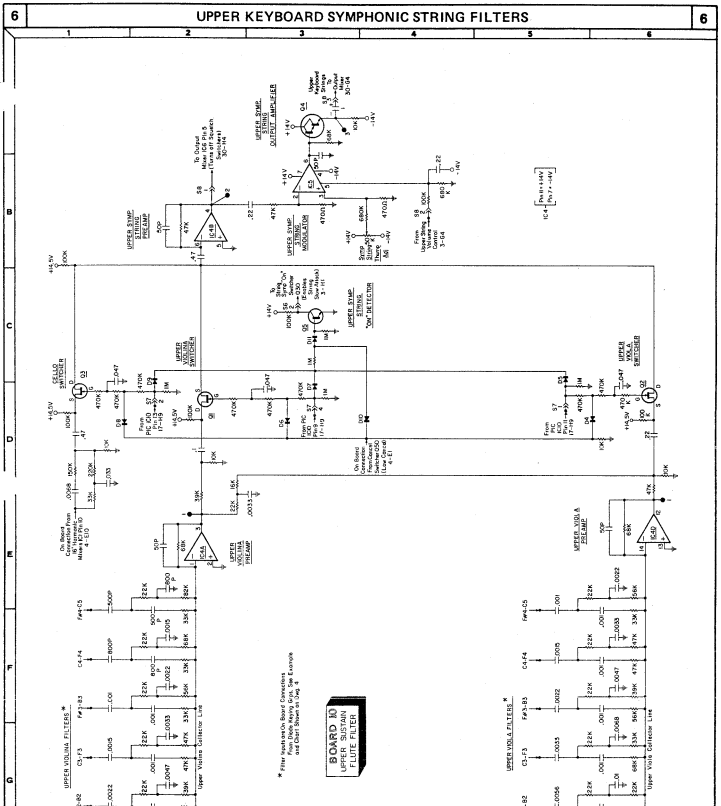
FRACTIONAL FLUTE KEYING CHART

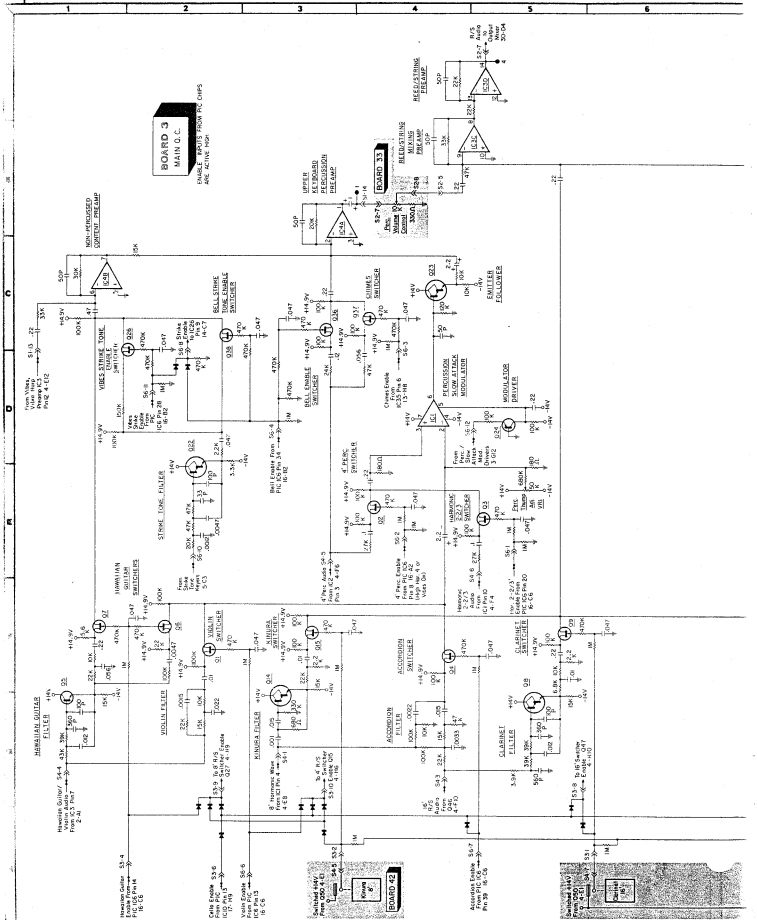
Decoder IC	Keyb Ref	Pin No.	Socket Desig. 2-2/3 B	2-2/3 C	5-1/3 D	5-1/3 E	Decoder IC	Keyb Ref.	Pin No.	Socket Desig. 2-2/3 B	2-2/3 C	5-1/3 D	5-1/3 E
IC1	C1	21	S5-1		S3-1		IC2	G3	12	S9-1		S7-1	
	C#2	22	S5-2		S3-2			G#3	13	S9-2		S7-2	
	D1	23	S5-3		S3-3			D3	14	S9-3	S2	S7-3	S2-4
	D#1	24	S5-4		S3-4			D#3	15	S9-4	11	S7-4	
	E1	25	S5-5		S3-5			E3	16	S9-5		S7-5	
	F1	26	S5-6	S2-8	S3-6	S2-1		F3	17	S9-6		S7-6	
	F#1	27	S6-1		S4-1			F#3	18	S9-7		S8-1	
	G1	28	S6-2		S4-2			G3	19	S11-6		S8-2	
	G#1	29	S6-3		S4-3			G#3	20	S11-5		S8-3	S2-5
	A1	30	S6-4		S4-4			A3	21	S11-4	S2	S8-4	
	A#1	31	S6-5		S4-5			A#3	22	S11-3	12	S8-5	
	B1	32	S6-6		S4-6			B3	23	S11-2		S8-6	
	C2	33	S7-1		S5-1			C4	24	S11-1		S9-1	
	C#2	34	S7-2		S5-2			C#4	25	S12-6		S9-2	
	D2	35	S7-3	S2-9	S5-3	S2-2		D#4	26	S12-5		S9-3	
	D#2	36	S7-4		S5-4			D#4	27	S12-4	S2	S9-4	S2-6
	E2	4	S7-5		S5-5			E4	28	S12-3	13	S9-5	
	F2	5	S7-6		S5-6			F4	29	S12-2		S9-6	
	F#2	6	S8-1		S6-1			F#4	30	S12-1		S9-7	
	G2	7	S8-2		S6-2			G4	31	S13-6		S11-6	
IC2	G#2	8	S8-3	S2	S6-3	S2-3		G#4	32	S13-5		S11-5	
	A2	9	S8-4	10	S6-4			A4	33	S13-4	S2	S11-4	S2-7
	A#2	10	S8-5		S6-5			A#4	34	S13-3	14	S11-3	
	B2	11	S8-6		S6-6			B4	35	S13-2		S11-2	
								C5	36	S13-1		S11-1	

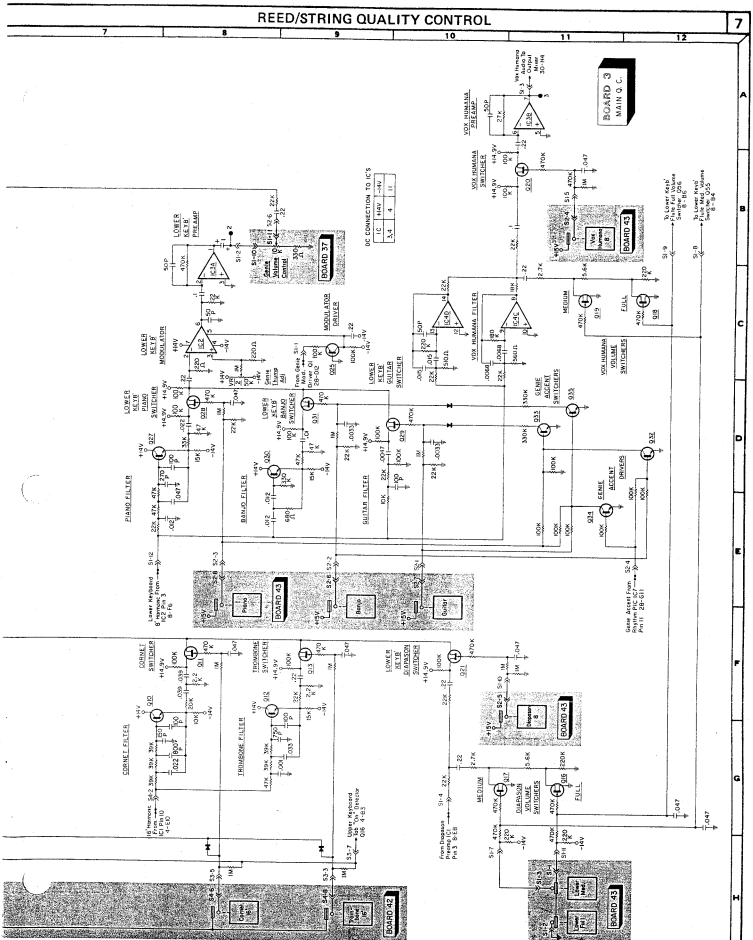
NETWORK DETAILS

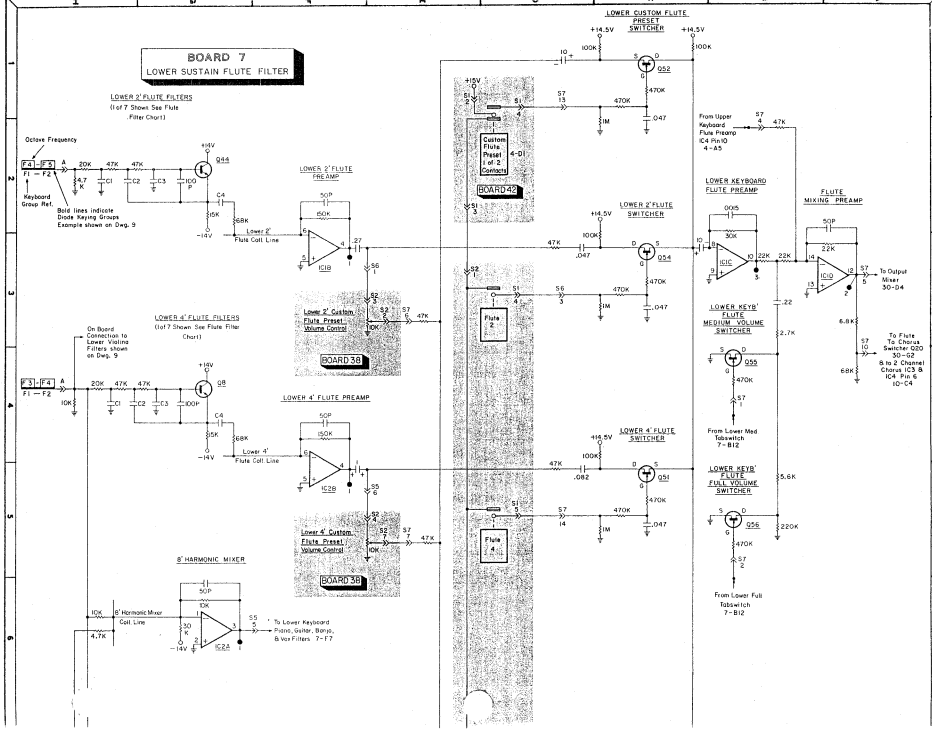


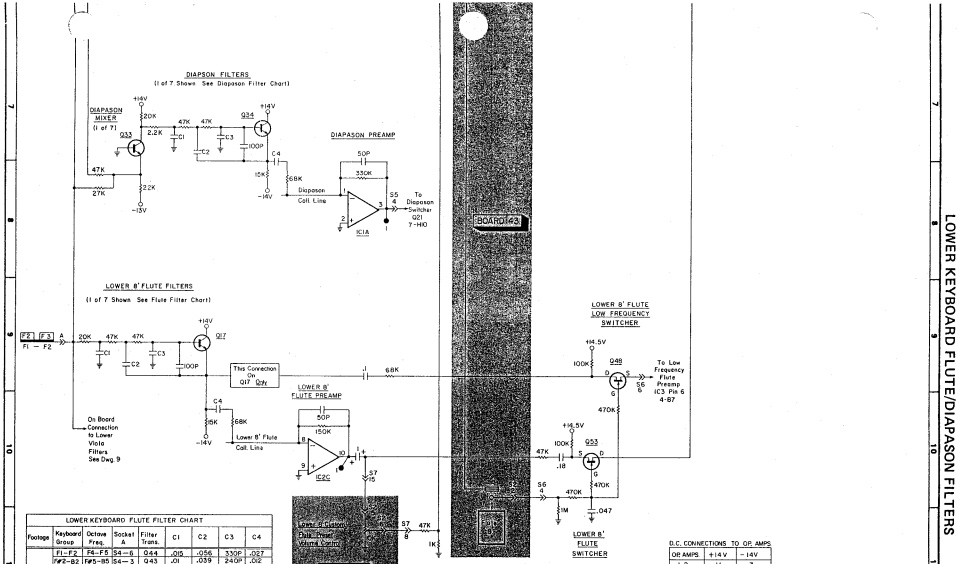
BOARD 23
UPPER FRACTIONAL KEYER


BOARD 10
UPPER STRING
FILTER
UPPER VIOLA FILTERS *
UPPER VIOLA FILTERS *
UPPER VIOLA SWITCHER
UPPER VIOLA PRESENCE
UPPER STRING VOICE SWITCHER
UPPER STRING OUTPUT AMPLIFIER
UPPER STRING TREMOLO
UPPER STRING MODULATION
UPPER STRING TOP OCTAVE
CELLO SWITCHER
* Filter Modulation Board Connections
Four Deck Keying Cycle, See Examples
and Effect Details, Vol. 4
Keyboard Gate
Shown for Ref. Only
Upper Violas Collective Line
On Board Connection From Misc. 4 Effects Sw. 1-10
On Board Connection From Cello Switcher 2-10
To Output Mixer Cell Resistors 3-104
From Upper Violas Switcher 3-104
From Upper Violas Switcher 3-104
From Tremolo Circuit 3-104
From Tremolo Circuit 3-104
From Tremolo Circuit


BOARD 3
MAIN O.C.
BOARD 33
BOARD 42
REED/STRING PREAMP
UPPER KEYBOARD PREAMP
NON-PROCESSED DIGITAL PREAMP
VIBES STRING TONE CHASE SWITCHES
BELL STRING TONE ENABLE SWITCHES
GUITAR SWITCHES
HARMONIA GUITAR FILTER
VIOLIN FILTER
STRING TONE FILTER
HARMONIA SWITCHES
VIOLIN SWITCHES
ACCORDION SWITCHES
ACCORDION FILTER
CLARINET SWITCHES
CLARINET FILTER
BELL ENABLE SWITCHES
GUITARS SWITCHES
PERCUSSION SLOW ATTACK MIXER
EMITTER FOLLOWER
MODULATOR DRIVER
REED/STRING PREAMP


REED/STRING QUALITY CONTROL
7
BOARD 3
MAIN V.C.
BOARD #2
BOARD #3
BOARD #7
CORNET FILTER
TROMBONE FILTER
PIANO FILTER
BRASS FILTER
GUITAR FILTER
VOX HUMANA FILTER
CORNET SWITCHES
TROMBONE SWITCHES
LOWER REED/STRING SWITCHES
LOWER REED/STRING VOLUME SWITCHES
VOX HUMANA SWITCHES
VOX HUMANA VOLUME SWITCHES
LOWER REED/STRING MODULATION
MODULATION DIVIDER
LOWER REED/STRING PREAMP
VOX HUMANA PREAMP
DC CONNECTION TO I/C'S
To Lower Keyboard Switches
To Lower Keyboard Switches
To Vox Humana Switches
Lower Keyboard
Upper Keyboard
Pedals
Vox Humana
Chorus
Piano
Guitar
Bass
Brass
Reed
Strings
Diapason
Volume
Control
Modulation
Preamp
Filter
Switches
Divider
Generator
Tone
Attack
Decay
Sustain
Release
Envelope
Keyboard
Pedal
Lower
Upper
Vox
Humana
Cornet
Trombone
Brass
Reed
Strings
Piano
Guitar
Bass
Chorus

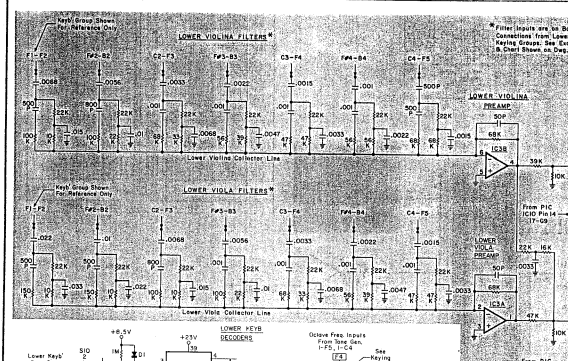

BOARD 7
LOWER SUSTAIN FLUTE FILTER
LOWER 2' FLUTE FILTERS
(1 of 7 Shows See Flute Filter Chart)
Octave Frequency
F4 - F5
F1 - F2
Keyboard Group Ref.
Bold lines indicate Diode Keying Groups Example shown on Dwg. 9
LOWER 2' FLUTE PREAMP
Lower 2' Flute Coil Line
LOWER 4' FLUTE FILTERS
(1 of 7 Shown See Flute Filter Chart)
On Board Connection to Lower Violina Filters shown on Dwg. 9
LOWER 4' FLUTE PREAMP
Lower 4' Flute Coil Line
8' HARMONIC MIXER
8' Harmonic Mixer Coil Line
To Lower Keyboard Piano, Guitar, Banjo, & Vox Filters 7-F7
LOWER CUSTOM FLUTE PRESET SWITCHER
Custom Flute Preset 4-01 1 of 2 Contacts
BOARD 42
Lower 2' Custom Flute Preset Volume Control
BOARD 38
Lower 4' Custom Flute Preset Volume Control
BOARD 38
Flute 2
Flute 2 4
LOWER 2' FLUTE SWITCHER
LOWER 4' FLUTE SWITCHER
From Upper Keyboard Flute Preamp IC4 Pin 10 4-A5
LOWER KEYBOARD FLUTE PREAMP
FLUTE MIXING PREAMP
To Output Mixer 30-D4
LOWER KEYB' FLUTE MEDIUM VOLUME SWITCHER
LOWER KEYB' FLUTE FULL VOLUME SWITCHER
From Lower Med Tabswitch 7-B12
From Lower Full Tabswitch 7-B12
To Flute To Chorus Switcher 020 30-G2 & to 2 Channel Chorus IC3 & IC4 Pin 6 10-C4

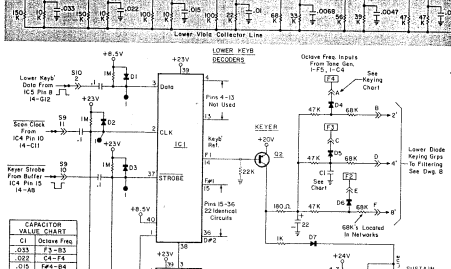


LOWER KEYBOARD FLUTE FILTER CHART							
Footage	Keyboard Group	Octave Freq.	Socket A	Filter Trans.	C1	C2	C3	C4
2'	F1–F2	F6–F5	S4 – 6	Q44	.015	.056	330P	.027
	F#2–B2	F#5–B5	S4 – 3	Q43	.01	.039	240P	.012
	C2–F3	C6–F6	S3 – 6	Q42	.0082	.027	160P	.0082
	F#3–B3	F#6–B6	S3 – 3	Q41	.0056	.022	120P	.0056
	C3–F4	C7–F7	S2 – 6	Q40	.0039	.015	82P	.0039
	F#4–B4	F#7–B7	S2 – 3	Q39	.0027	.01	56P	.0027
4'	C4–F5	C8–F8	S1 – 3	Q38	.0018	.0068	39P	.0022
	F1–F2	F3–F4	S5 – 5	Q8	.033	.12	680P	.047
	F#2–B2	F#4–B4	S4 – 2	Q7	.022	.082	470P	.022
	C2–F3	C5–F5	S3 – 5	Q6	.015	.056	330P	.015
	F#3–B3	F#5–B5	S3 – 2	Q5	.01	.039	240P	.012
	C3–F4	C6–F6	S2 – 5	Q4	.0082	.027	160P	.0082
	F#4–B4	F#6–B6	S2 – 2	Q3	.0056	.022	120P	.0056
	C4–F5	C7–F7	S1 – 2	Q2	.0039	.015	82P	.0039
8'	F1–F2	F2–F3	S4 – 4	Q17	.056	.22	.0012	.1
	F#2–B2	F#3–B3	S4 – 1	Q16	.039	.18	.001	.047
	C2–F3	C4–F4	S3 – 4	Q15	.033	.12	680P	.033
	F#3–B3	F#4–B4	S3 – 1	Q14	.022	.082	470P	.022
	C3–F4	C5–F5	S2 – 4	Q13	.015	.056	330P	.015
	F#4–B4	F#5–B5	S2 – 1	Q12	.01	.039	240P	.012
	C4–F5	C6–F6	S1 – 1	Q11	.0082	.027	160P	.0082

DIAPASON FILTER CHART						
Keyb. Group	Mixer	Filter Trans	C1	C2	C3	C4
F1–F2	Q33	Q34	.033	.12	680P	.1
F#2–B2	Q31	Q32	.022	.082	470P	.047
C2–F3	Q29	Q30	.015	.056	330P	.033
F#3–B3	Q27	Q28	.01	.039	240P	.022
C3–F4	Q25	Q26	.0082	.027	160P	.015
F#4–B4	Q23	Q24	.0056	.022	120P	.012
C4–F5	Q21	Q22	.0039	.015	82P	.0082

B.C. CONNECTIONS TO OP AMPS		
OP AMPS	+14V	-14V
1, 2	11	7


LOWER VIOLINA FILTERS*
LOWER VIOLA FILTERS*
Keyb' Group Shown For Reference Only
Lower Violina Collector Line
Lower Viola Collector Line
LOWER VIOLINA PREAMP
LOWER VIOLA PREAMP
LOWER VIOLINA SWITCHER
LOWER VIOLA SWITCHER
LOWER SYMP STRING PREAMP
LOWER SYMP STRING VOLUME REGULATOR
EMITTER FOLLOWER
From PIC IC10 Pin 14 17-09
From PIC IC10 Pin 12 17-09
To Output Mixer IC6 Pin 5 (Turns Off Sparish Switches) 30-H4
Output Mixer 30-D4
D.C. CONNECTIONS TO OP AMPS
Op Amps +14V -14V
2, 3 11 7
* Filter Inputs are on Board Connections From Lower Diode Keying Groups. See Example in Chart Shown on Dwg. B
BOARD 7
BOARD 36

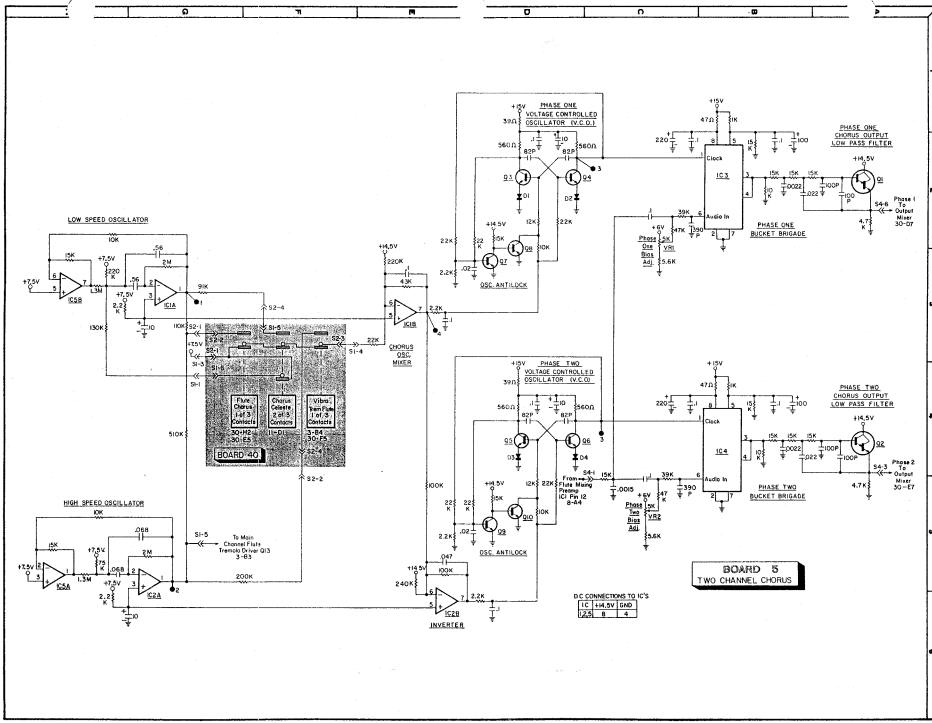

LOWER KEYB DECODERS
Octave Freq. Inputs From Tone Gen. I-F5, I-C4
See Keying Chart
Lower Keyb' Data From IC5 Pin 8 14-G12
Scan Clock From IC4 Pin 10 14-C11
Keyer Strobe From Buffer IC4 Pin 15 14-A8
KEYER
Keyb' Ref. No.
Lower Diode Keying Grps To Filtering See Dwg. B
68K Located In Networks
Pins 15-36 22 Identical Circuits
Pins 4-29 26 Identical Circuits
Pins 30-36 Not Used
Pins 4-13 Not Used
Outputs Switch Low When Keyed
SUSTAIN LENGTH REGULATOR
SUSTAIN ENABLE SWITCHER
Common Sustain Line
Sust. Lower
949-022779
ALL 68K's
BOARD 41
BOARD 21
LOWER SUSTAIN KEYER

CAPACITOR VALUE CHART

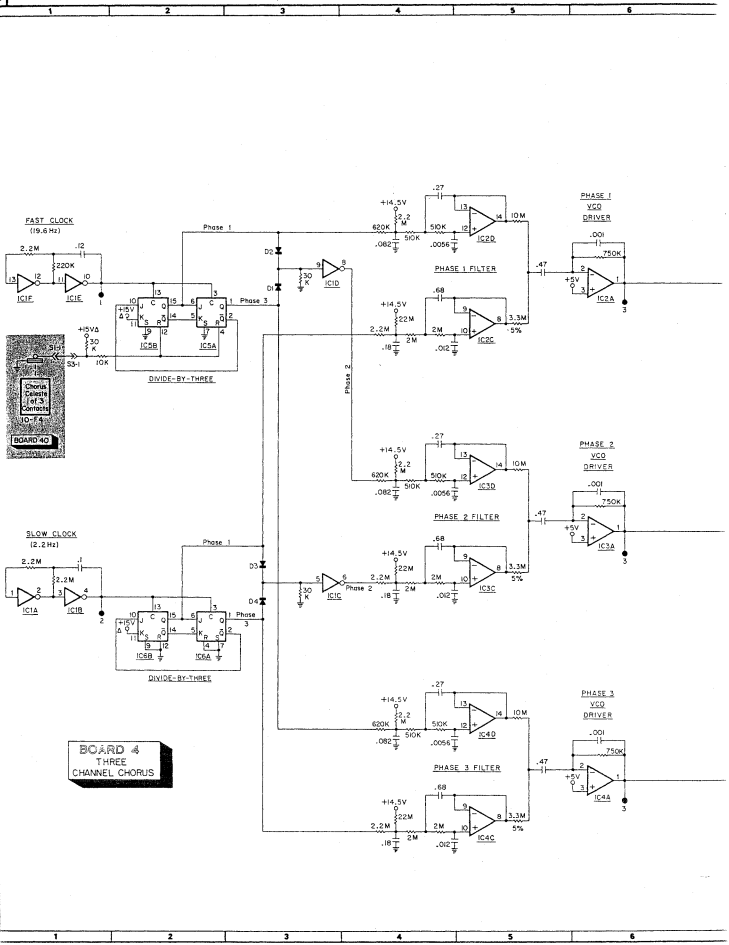
Ci	Octave Freq
.033	F3-B3
.022	C4-F4
.015	F#4-B4
.01	C5-F5
.0068	F#5-B5
.0047	C6-F6
.0033	F#6-B6
.0022	C7-F7

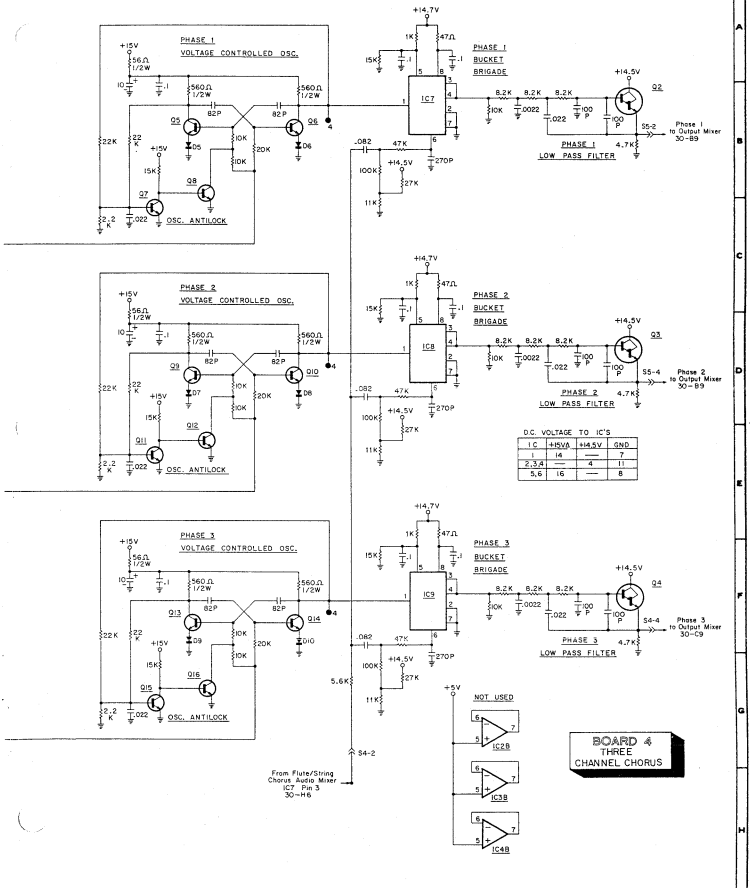
LOWER KEYBOARD KEYING CHART

Decoder IC	Keyb' Ref. No.	Pin No.	Keyer Q No.	Socket Designation 2' A	2' B	4' A	4' B	8' D	8' E	8' F
IC1	F1	14	2	S1-1		S6-11		S6-13		
	F#1	15	3	S2-12		S1-12		S6-12		
	G1	16	4	S2-11		S1-11		S6-11		
	G#1	17	5	S2-10		S1-10		S6-10		
	A1	18	6	S2-9		S1-9		S6-9		
	A#1	19	7	S2-8		S1-8	S3-7	S6-8		S11-7
	B1	20	8	S2-7		S1-7		S6-7		
	C1	21	9	S2-6		S1-6		S6-6		
	C#1	22	10	S2-5		S1-5		S6-5		
	D1	23	11	S2-4		S1-4		S6-4		
	D#1	24	12	S2-3		S1-3		S6-3		
	E1	25	13	S2-2		S1-2		S6-2		
	F2	26	14	S2-1		S1-1		S6-1		
	F#2	27	15	S4-12		S2-12		S7-12		
	G2	28	16	S4-11		S2-11		S7-11		
	G#2	29	17	S4-10	S7-6	S2-10	S3-9	S7-10	S11-6	
	A2	30	18	S4-9		S2-9		S7-9		
	A#2	31	19	S4-8		S2-8		S7-8		
	B2	32	20	S4-7		S2-7		S7-7		
	C2	33	21	S4-6		S2-6		S7-6		
	C#2	34	22	S4-5		S2-5		S7-5		
	D2	35	23	S4-4	S7-5	S2-4	S3-5	S7-4	S11-5	
	D#2	36	24	S4-3		S2-3		S7-3		
IC2	E2	4	25	S4-2		S2-2		S7-2		
	F3	5	26	S4-1		S2-1		S7-1		
IC2	F#3	6	27	S5-12		S4-12		S8-12		
	G3	7	28	S5-11		S4-11		S8-11		
	G#3	8	29	S5-10	S7-4	S4-10	S3-4	S8-10	S11-4	
	A3	9	30	S5-9		S4-9		S8-9		
	A#3	10	31	S5-8		S4-8		S8-8		
	B3	11	32	S5-7		S4-7		S8-7		
	C4	12	33	S5-6		S4-6		S8-6		
	C#3	13	34	S5-5		S4-5		S8-5		
	D3	14	35	S5-4		S4-4		S8-4		
	D#3	15	36	S5-3	S7-3	S4-3	S3-3	S8-3	S11-3	
	E3	16	37	S5-2		S4-2		S8-2		
	F4	17	38	S5-1		S4-1		S8-1		
	F#4	18	39	S6-12		S5-12		S8-12		
	G4	19	40	S6-11		S5-11		S9-11		
	G#4	20	41	S6-10		S5-10		S9-10		
	A4	21	42	S6-9		S5-9	S3-2	S9-9	S11-2	
	A#4	22	43	S6-8		S5-8		S9-8		
	B4	23	44	S6-7		S5-7		S9-7		
	C5	24	45	S6-6		S5-6		S9-6		
	C#4	25	46	S6-5		S5-5		S9-5		
	D4	26	47	S6-4		S5-4	S3-1	S9-4	S11-1	
	D#4	27	48	S6-3		S5-3		S9-3		
	E4	28	49	S6-2		S5-2		S9-2		
	F5	29	50	S6-1		S5-1		S9-1		


LOW SPEED OSCILLATOR
HIGH SPEED OSCILLATOR
PHASE ONE VOLTAGE CONTROLLED OSCILLATOR (V.C.O.)
PHASE TWO VOLTAGE CONTROLLED OSCILLATOR (V.C.O.)
OSC. ANTILOCK
CHORUS OSC. MIXER
INVERTER
PHASE ONE BUCKET BRIGADE
PHASE TWO BUCKET BRIGADE
PHASE ONE CHORUS OUTPUT LOW PASS FILTER
PHASE TWO CHORUS OUTPUT LOW PASS FILTER
Phase 1 To Output Mixer 30-G7
Phase 2 To Output Mixer 30-E7
To Main Chorus Flute Tremolo Driver QI3 3-B3
From Flute Mixing Preamp IC1 Pin 12 B-A4
BOARD 40
Flute Chorus 1 of 3 Controls
Chorus Celeste 2 of 3 Controls
Vibes Bass Flute 1 of 3 Controls
BOARD 5
TWO CHANNEL CHORUS
D.C CONNECTIONS TO IC'S
IC | +14.5V | GND
IC2A 8 4

FLUTE/STRING CHORUS MODULATOR

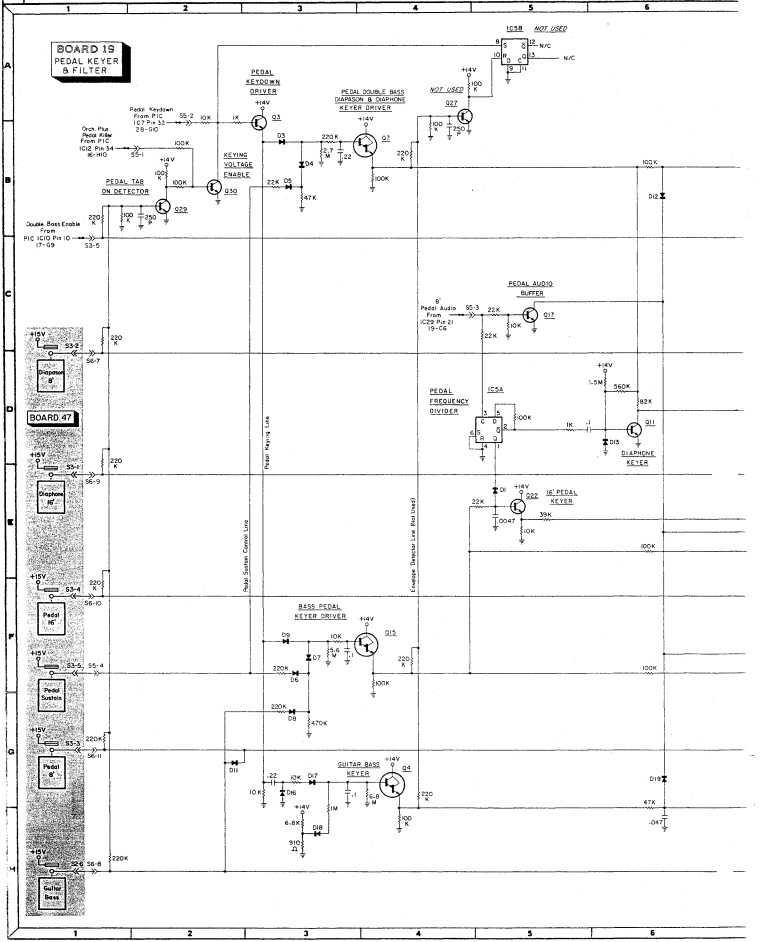


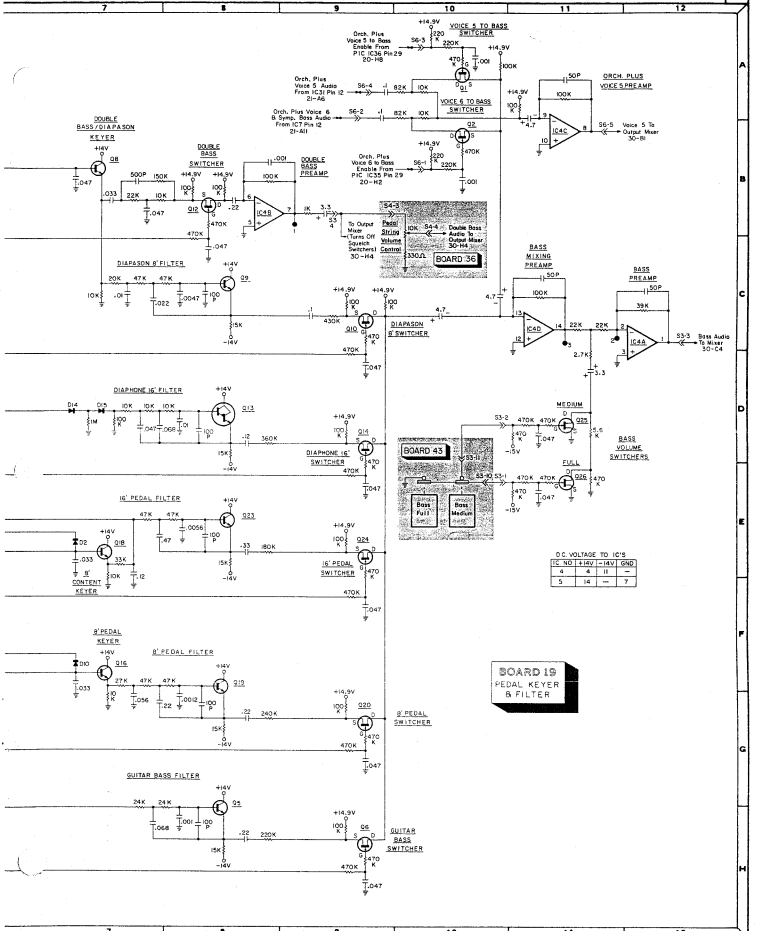


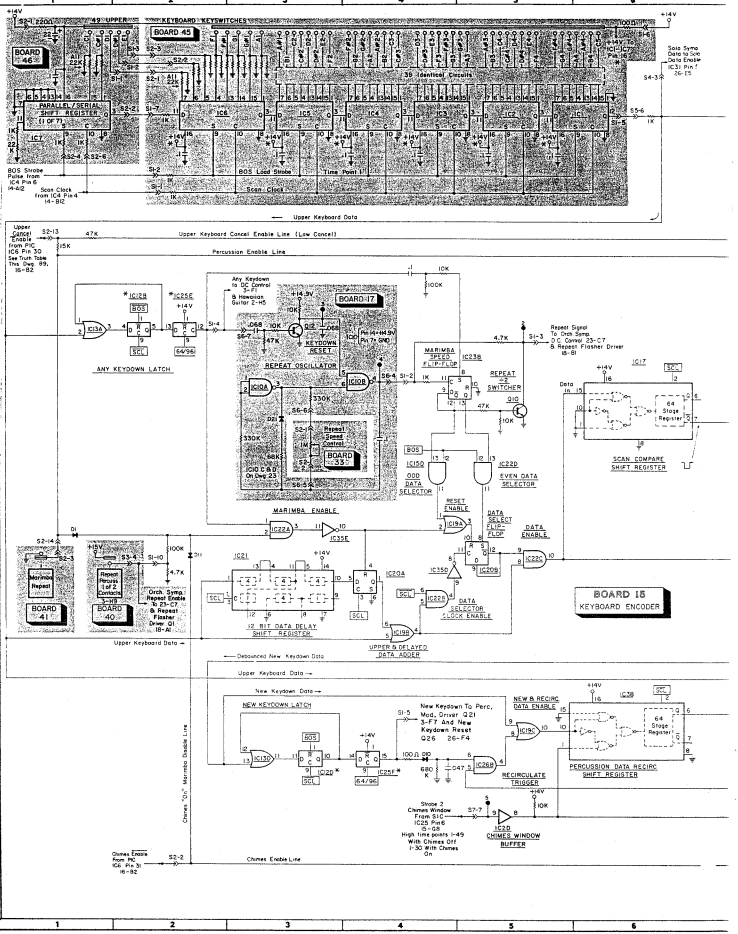
D.C. VOLTAGE TO IC'S

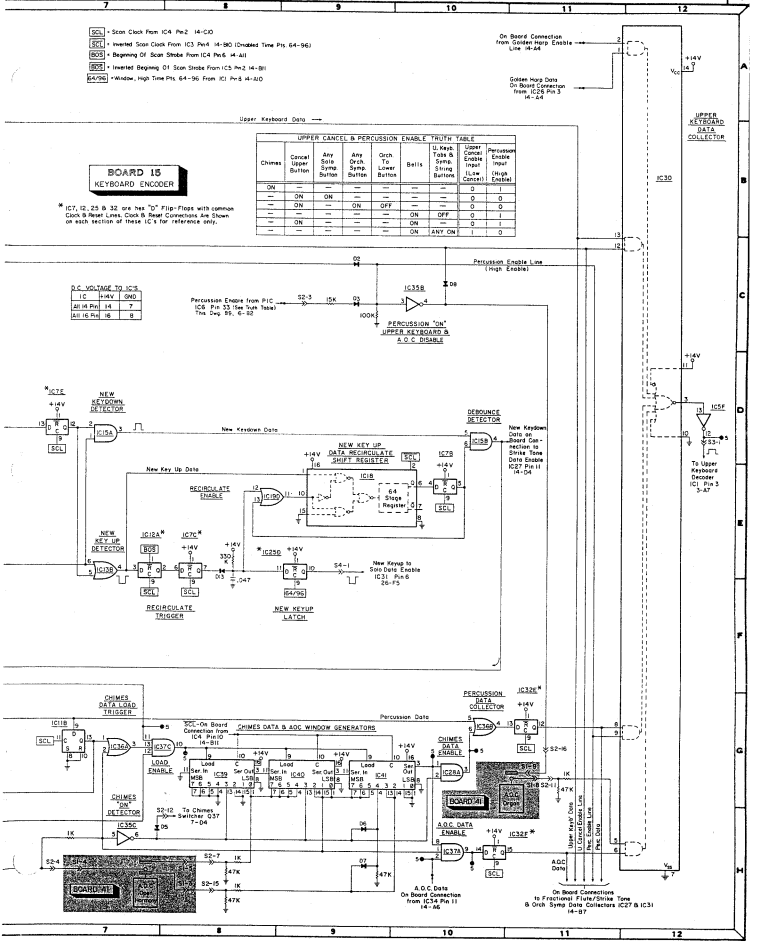
IC	+15V@	+14.5V	GND
1	14	—	7
2,3,4	—	4	11
5,6	16	—	8

BASS QUALITY CONTROL

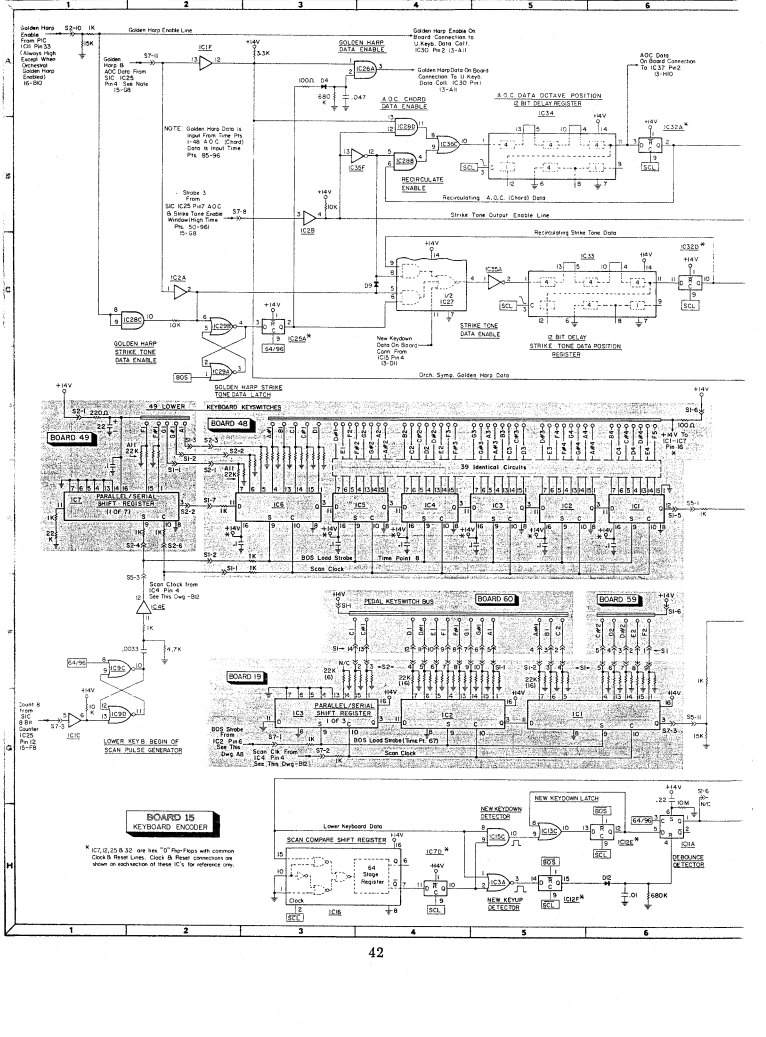



VOICE 5 TO BASS SWITCHER
VOICE 6 TO BASS SWITCHER
ORCH. PLUS VOICE 5 PREAMP
DOUBLE BASS/DIAPASON KEYER
DOUBLE BASS SWITCHER
DOUBLE BASS PREAMP
Double Bass Audio To Output Mixer 30-H4
BOARD 36
BASS MIXING PREAMP
BASS PREAMP
Bass Audio To Mixer 30-C4
DIAPASON 8' FILTER
DIAPASON 8' SWITCHER
DIAPHONE 16' FILTER
DIAPHONE 16' SWITCHER
16' PEDAL FILTER
16' PEDAL SWITCHER
8' PEDAL KEYER
8' PEDAL FILTER
9' PEDAL SWITCHER
GUITAR BASS FILTER
GUITAR BASS SWITCHER
MEDIUM
BASS VOLUME SWITCHERS
FULL
BOARD 43
BOARD 19
PEDAL KEYER & FILTER
DC VOLTAGE TO IC'S
IC NO | +14V | -14V | GND
4 | 14 | 11 | —
5 | 14 | — | 7


13
KEYBOARD ENCODER I
BOARD 46
BOARD 45
KEYBOARD - KEYSWITCHES
39 Identical Circuits
PARALLEL / SERIAL SHIFT REGISTER
BOARD 17
KEYDOWN RESET
REPEAT OSCILLATOR
MARIMBA SPEED FLIP-FLOP
REPEAT SWITCHER
ANY KEYDOWN LATCH
MARIMBA ENABLE
DATA SELECTOR
EVEN DATA SELECTOR
SCAN COMPARE SHIFT REGISTER
12 BIT DATA DELAY SHIFT REGISTER
UPPER & DELAYED DATA ADDER
DATA SELECTOR CLOCK ENABLE
DATA ENABLE
BOARD 15
KEYBOARD ENCODER
BOARD 41
BOARD 40
BOARD 33
NEW KEYDOWN LATCH
NEW & RECIRC DATA ENABLE
RECIRCULATE TRIGGER
PERCUSSION DATA RECIRC SHIFT REGISTER
CHIMES WINDOW BUFFER
Upper Keyboard Data
Upper Keyboard Concel Enable Line (Low Concel)
Percussion Enable Line
Upper Keyboard Data →
Debounced New Keydown Data
New Keydown Data →
Chimes Enable Line

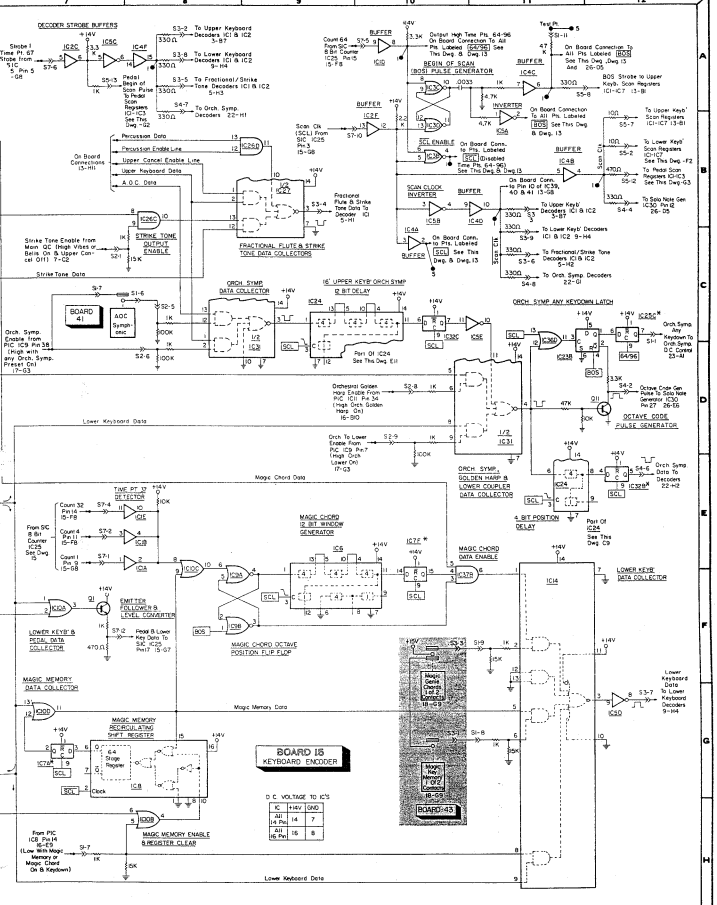

KEYBOARD ENCODER I
SCL = Scan Clock From IC4 Pin2 14-C10
SCL = Inverted Scan Clock From IC3 Pin9 14-B10 (Enabled Time Pts. 64-96)
BOS = Beginning Of Scan Strobe From IC4 Pin6 14-A11
BOS = Inverted Beginning Of Scan Strobe From IC5 Pin2 14-B11
64/96 = Window, High Time Pts. 64-96 From IC1 Pin5 14-A10
On Board Connection from Golden Harp Enable Line 14-A6
Golden Harp Data On Board Connection from IC24 Pin 3 14-A4
Upper Keyboard Data
UPPER KEYBOARD DATA COLLECTOR
IC30
BOARD 15 KEYBOARD ENCODER
UPPER CANCEL & PERCUSSION ENABLE TRUTH TABLE
Chimes
Cancel Upper Button
Any Solo Symp. Button
Any Orch. Symp. Button
Orch To Lower Button
Bells
U. Kyb. Tabs & Symp. String Buttons
Upper Cancel Enable Input (Low Cancel)
Percussion Enable Input (High Enable)
ON — — — — — 0 1
— ON ON — — — — 0 0
— ON — ON OFF — — 0 0
— — — — — ON OFF 0 1
— ON — — — ON — 0 1
— — — — — ON ANY ON 1 0
* IC7, 12, 25 & 32 are hex "D" Flip-Flops with common Clock & Reset Lines. Clock & Reset Connections Are Shown on each section of these IC's for reference only.
D.C. VOLTAGE TO IC'S
I.C. +14V GND
All (4 Pin) 14 7
All (16 Pin) 16 8
Percussion Enable Line (High Enable)
Percussion Enable from PIC IC6 Pin 33 (See Sum Table) This Dwg. 99, 6-32
S2-3
15K
100K
IC33B
PERCUSSION "ON" UPPER KEYBOARD & A.O.C. DISABLE
DEBOUNCE DETECTOR
IC15A
IC15B
IC15F
New Keydown Data
New Keydown Data to Board Connection to Strike Tone Data Enable IC27 Pin 11 14-D4
To Upper Keyboard Decoder IC1 Pin 3 D-A7
NEW KEYDOWN DETECTOR
NEW KEY UP DATA RECIRCULATE SHIFT REGISTER
64 Stage Shift Register
IC7B
IC1B
IC19B
New Key Up Data
RECIRCULATE ENABLE
NEW KEY UP DETECTOR
IC13A
IC7C
IC23B
S4-1
New Keyup to Solo Data Enable IC31 Pin 6 26-F5
RECIRCULATE TRIGGER
NEW KEYUP LATCH
CHIMES DATA LOAD TRIGGER
IC11B
IC36B
IC37C
LOAD ENABLE
SCC-On Board Connection from IC4 Pin10 14-B11
CHIMES DATA & AOC WINDOW GENERATORS
Percussion Data
PERCUSSION DATA COLLECTOR
IC32B
IC36A
S2-16
IC39
IC40
IC41
Load MSB
Ser In
Ser Out
Load LSB
CHIMES DATA ENABLE
IC28A
IC28B
BOARD 5A
Chimes Data Origin
CHIMES "ON" DETECTOR
IC35C
S2-12
To Chimes Switcher Q37 7-D4
A.O.C. DATA ENABLE
IC37A
IC32F
A.O.C. Data On Board Connection from IC34 Pin 11 14-A6
A.O.C. Data
User Keyb'd Data
U. Cancel Enable Line
Perc. Enable Line
Perc. Data
On Board Connections to Fractional Flute/Strike Tone & Orch. Symp. Data Collectors IC27 & IC31 14-B7
BOARD 14
A.O.C. Data Origin
S2-4
S2-7
S2-15
1K
47K
D5
D6
D7
D8
+14V
Vcc
330
.047

KEYBOARD ENCODER II

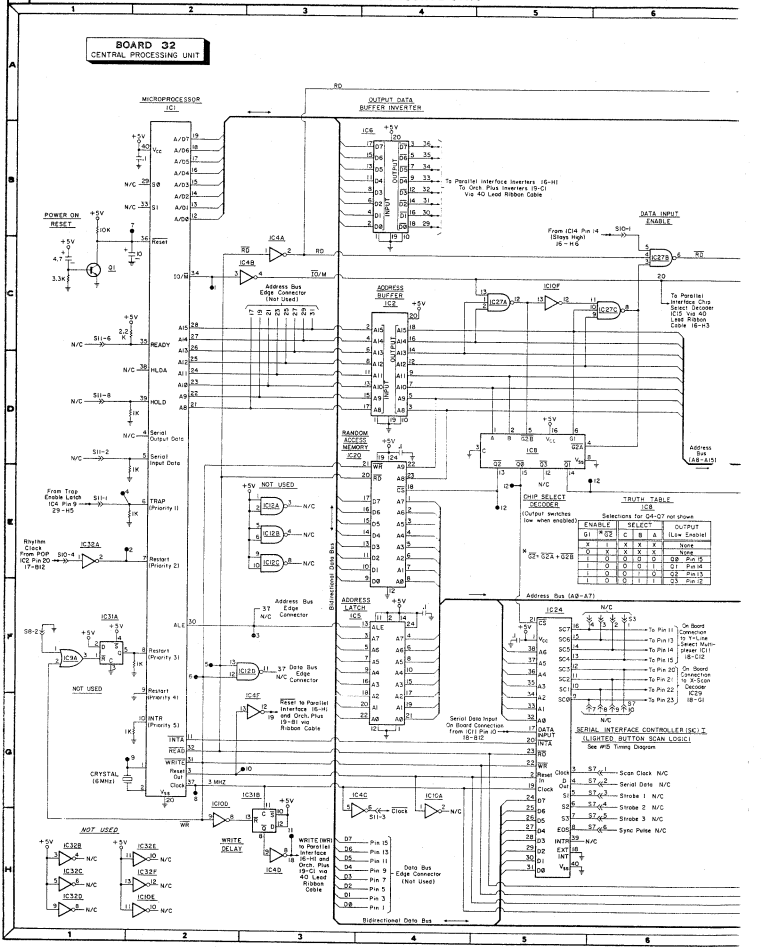


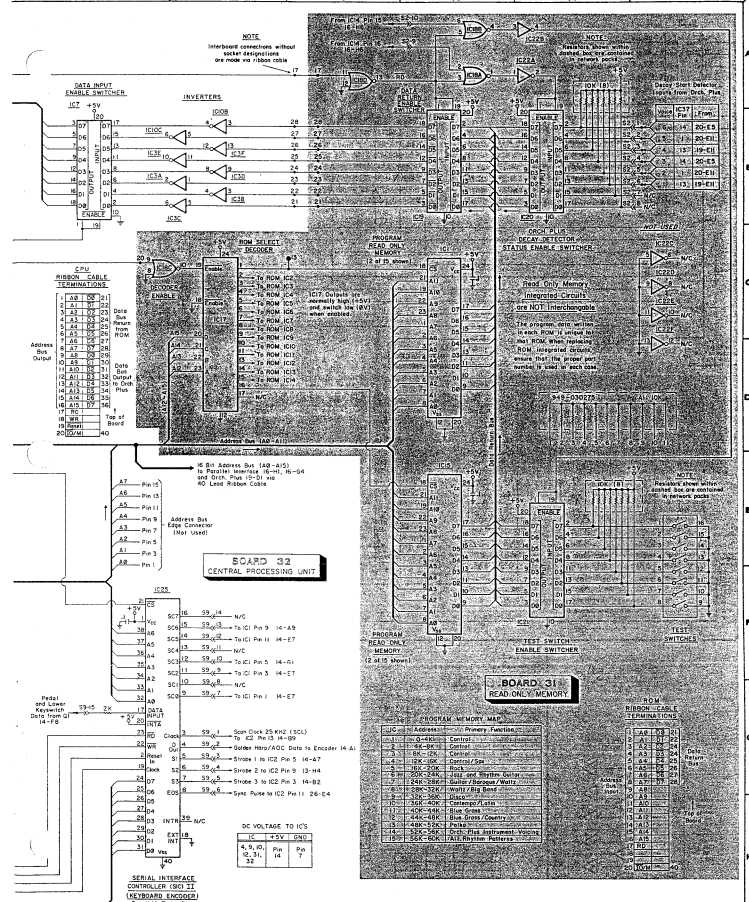
* IC1, IC2, IC5-IC32 are two "D" Flip-Flops with common Clock & Reset Lines. Clock & Reset connections are shown on eachsection of these IC's for reference only.

KEYBOARD ENCODER II

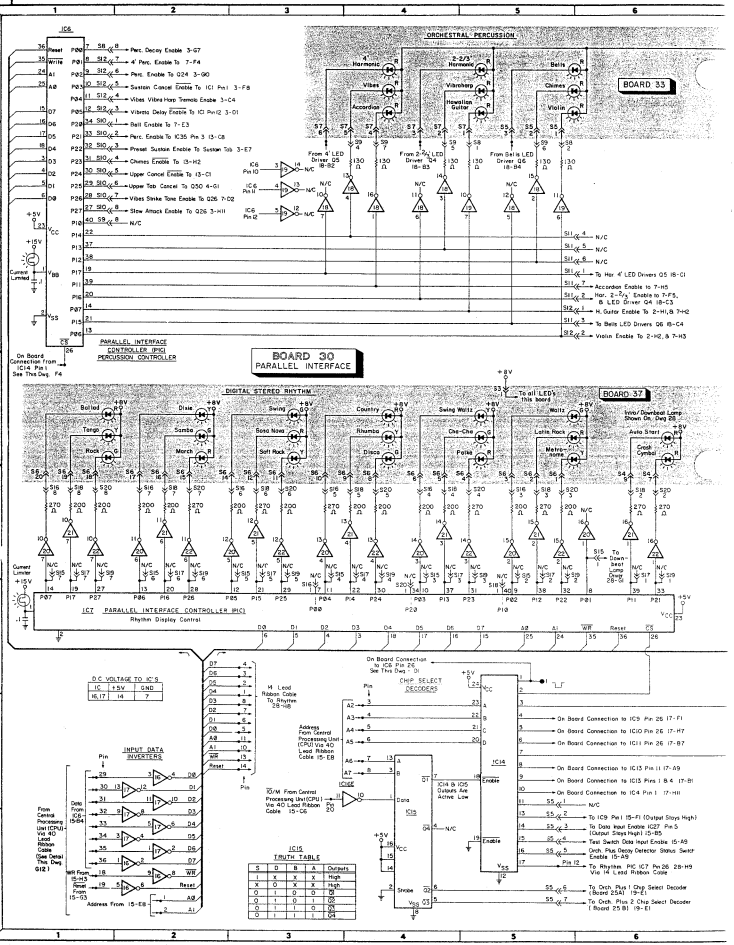

DECODER STROBE BUFFERS
Strobe 1 Time Pt. 67 Strobe from 91C 5. Pin 5 -GR
S7-6
IC2C
IC6C
IC4F
S3-2 To Upper Keyboard Decoders IC1 & IC2 5-87
S3-8 To Lower Keyboard Decoders IC1 & IC2 9-H4
S3-5 To Fractional/Strike Tone Decoders IC1 & IC2 5-H3
S5-3 Pedal Begin of Scan Pulse Under Scan Registers IC1-C3 See This Dwg -I2
S4-7 To Orch. Symp Decoders 22-H1
Percussion Data
Percussion Enable Line
Upper Keyboard Data
A.D.C. Data
On Board Connections I5-H1
IC2C
IC2D
S3-4 Fractional Flute & Strike Tone Data Decoder IC1 5-H1
FRACTIONAL FLUTE & STRIKE TONE DATA COLLECTORS
Strike Tone Enable from Main QC (High Vbias or Bein On & Upper Concel Off) 7-C2
S21
STRIKE TONE OUTPUT ENABLE
Strike Tone Data
S7
S1-6
BOARD 41
ADC Symph selec
S2-5
S2-6
ORCH SYMP DATA COLLECTOR
IC24
IC3A
IC3B
16' UPPER KEYB ORCH SYMP 12 BIT DELAY
IC3C
IC5E
Part Of IC24 See This Dwg. E11
Orch. Symp Enable from PIC IC9 Pin 38 (High with any Orch. Symp. Preset On) 17-G3
Orchestral Golden Harp Enable From PIC IC1 Pin 34 (High Orch Golden Harp On) I6-J90
S2-8
Orch To Lower Enable From PIC IC9 Pin7 (High Orch Lower On) 17-G3
S2-9
IC1/2 IC3I
ORCH SYMP. GOLDEN HARP & LOWER COUPLER DATA COLLECTOR
ORCH SYMP. ANY KEYDOWN LATCH
IC25D
IC3G
IC3H
IC3B
64/96
Orch Symp Any Keydown To Orch Symp D/C Delay 23-A1
Orch Symp Data To IC39A 22-H2
OCTAVE CODE PULSE GENERATOR
Octave Code Gen Pulse To Solo Note Generator IC30, Pin 27 26-I5
Lower Keyboard Data
Magic Chord Data
TIME PT 37 DETECTOR
S7-4
IC1E
From SYC 8 Bit Counter IC25 Set Dwg 15
Count 32 Pin16 I5-F8
Count 4 Pin13 I5-F8
Count 1 Pin 9 I5-G8
S7-2
S7-1
IC1B
IC1A
IC1C
MAGIC CHORD 12 BIT WINDOW GENERATOR
IC5
IC2A
IC2B
IC2C
IC2D
IC2E
IC2F
IC2G
IC2H
IC2J
IC2K
IC2L
IC2M
IC2N
IC2P
IC2R
IC2S
IC2T
IC2U
IC2V
IC2W
IC2X
IC2Y
IC2Z
IC3A
IC3B
IC3C
IC3D
IC3E
IC3F
IC3G
IC3H
IC3I
IC3J
IC3K
IC3L
IC3M
IC3N
IC3P
IC3R
IC3S
IC3T
IC3U
IC3V
IC3W
IC3X
IC3Y
IC3Z
IC4A
IC4B
IC4C
IC4D
IC4E
IC4F
IC4G
IC4H
IC4J
IC4K
IC4L
IC4M
IC4N
IC4P
IC4R
IC4S
IC4T
IC4U
IC4V
IC4W
IC4X
IC4Y
IC4Z
IC5A
IC5B
IC5C
IC5D
IC5E
IC5F
IC5G
IC5H
IC5J
IC5K
IC5L
IC5M
IC5N
IC5P
IC5R
IC5S
IC5T
IC5U
IC5V
IC5W
IC5X
IC5Y
IC5Z
IC6A
IC6B
IC6C
IC6D
IC6E
IC6F
IC6G
IC6H

CENTRAL PROCESSING UNIT


BOARD 32
CENTRAL PROCESSING UNIT
MICROPROCESSOR IC1
OUTPUT DATA BUFFER INVERTER IC6
ADDRESS BUFFER IC2
ADDRESS LATCH IC5
RANDOM ACCESS MEMORY IC20
CHIP SELECT DECODER IC8
TRUTH TABLE IC8
IC24
SERIAL INTERFACE CONTROLLER (SCI) T
ILLUMINATED BUTTON SCAN LOGIC
POWER ON RESET
DATA INPUT ENABLE
ADDRESS BUS (A8-A15)
BIDIRECTIONAL DATA BUS
NOT USED
WRITE DELAY
CRYSTAL (6 MHz)
Address Bus Edge Connector (Not Used)
Data Bus Edge Connector (Not Used)
To Parallel Interface Inverters (G-H) To Orch. Plus Inverters (9-C) Via 40 Lead Ribbon Cable
To Parallel Interface Chip Select Decoder (10) Via 40 Lead Ribbon Cable (B-H3)
From Trap Enable Latch IC4 Pin 9 29-H5
Rhythm Clock From POP IC8 Pin 20 17-B12
Serial Output Data
Serial Input Data
TRAP (Priority 1)
Restart (Priority 2)
Restart (Priority 3)
Restart (Priority 4)
INTR (Priority 5)
Reset To Parallel Interface (G-H) and Orch. Plus (9-B) via Ribbon Cable
Serial Data Input On Board Connection From IC1 Pin 10 (B-B12
On Board Connection To Y-Line Select Multiplexer IC11 (B-C12
On Board Connection To X-Scan Decoder IC29 (B-G1
Scan Clock N/C
Serial Data N/C
Strobe 1 N/C
Strobe 2 N/C
Strobe 3 N/C
Sync Pulse N/C
Bidirectional Data Bus

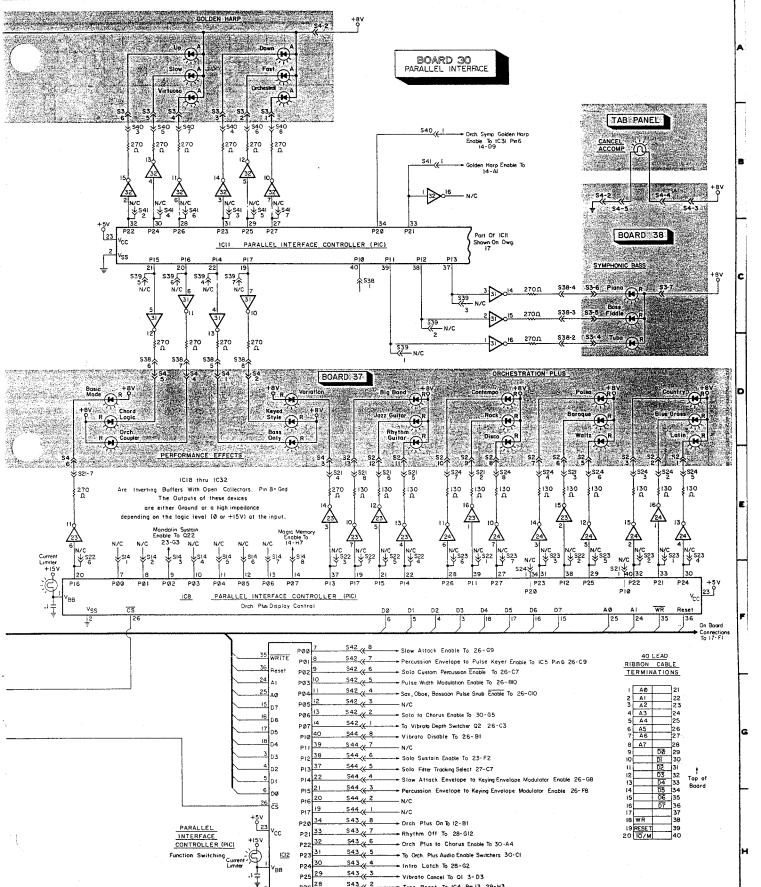

NOTE
Interboard connections without socket designations are made via ribbon cable
DATA INPUT ENABLE SWITCHES
INVERTERS
IC6B
IC6C
IC6A
IC6D
IC6E
IC6F
IC5A
IC5B
IC5C
IC5D
IC5E
IC5F
IC4A
IC4B
IC4C
IC4D
IC4E
IC4F
IC3A
IC3B
IC3C
IC3D
IC3E
IC3F
IC2A
IC2B
IC2C
IC2D
IC2E
IC2F
IC1A
IC1B
IC1C
IC1D
IC1E
IC1F
ENABLE
DATA INPUT
Decay Start Detector Inputs from Orch. Pins
Voice
IC1/7 (Pin)
Decay Start Detector Outputs
PROGRAM READ ONLY MEMORY (2 of 25 shown)
ROM SELECT DECODER
ENABLE
IC1C7. Outputs are normally high (+5V) and switch low (0V) when enabled.
To ROM IC2
To ROM IC3
To ROM IC4
To ROM IC5
To ROM IC6
To ROM IC7
To ROM IC8
To ROM IC9
To ROM IC10
To ROM IC11
To ROM IC12
To ROM IC14
N/C
address bus (A0-A15)
ORCH PLUS DECAY-DETECTOR STATUS ENABLE SWITCHES
not used
Read Only Memory Integrated Circuits are NOT Interchangeable
The program data written in each ROM is unique to that ROM. When replacing ROM integrated circuits ensure that the proper part number is used in each case.
NOTE:
Resistors shown within dashed box are contained in network packs
CPU RIBBON CABLE TERMINATIONS
Data Bus Return from ROM
Data Bus Output Plus
Top of Board
Address Bus Output
16 Bit Address Bus (A0-A15) to Parallel Inputs 16-H1, 16-G4 and Orch. Plus (O-D1 via 40 Lead Ribbon Cable
Address Bus Edge Connector (Not Used)
BOARD 32 CENTRAL PROCESSING UNIT
IC2S
Clock
Reset In
Clock
Data Input Strobe 1
Data Input Strobe 2
Data Input Strobe 3
Sync Pulse
INTR
EXT BUS MAT
Pedal and Lower Keyswitch Data from J1 14-F8
S9-45 2K
Scan Clock 25 KHz (SCL)
To IC2 Pin 13 14-B9
Guitar Harp/ADC Data to Encoder 14-A1
Strobe 1 to IC2 Pin 5 14-A7
Strobe 2 to IC2 Pin 9 13-H4
Strobe 3 to IC2 Pin 3 14-B2
Sync Pulse to IC2 Pin 11 26-E4
DC VOLTAGE TO IC'S
IC | +5V | GND
4, 9, 10, 12, 31, 32 | Pin 14 | Pin 7
SERIAL INTERFACE CONTROLLER (SIC) 21 (KEYBOARD ENCODER)
See sht 16 Timing Diagram
PROGRAM READ ONLY MEMORY
TEST SWITCH ENABLE
TEST SWITCHES
BOARD 31 READ-ONLY MEMORY
IC | Address | Primary Function
0-4K | Control
4K-8K | Control
8K-12K | Control
12K-16K | Control/Sax
16K-20K | Rock and Shuffle
20K-24K | Jazz and Rhythm Guitar
24K-28K | Guitar/Baroque/Watts
28K-32K | Watts/Big Band
32K-36K | Oboe
36K-40K | Trumpet/Tuba
40K-44K | Blue Grass
44K-48K | Blue Grass/Country
48K-52K | Polka
52K-56K | Orchestral Instrument Voices
56K-60K | All Rhythm Patterns
ROM RIBBON CABLE TERMINATIONS
Address Bus Input
Data Return from ROM
Top of Board

PARALLEL INTERFACE I

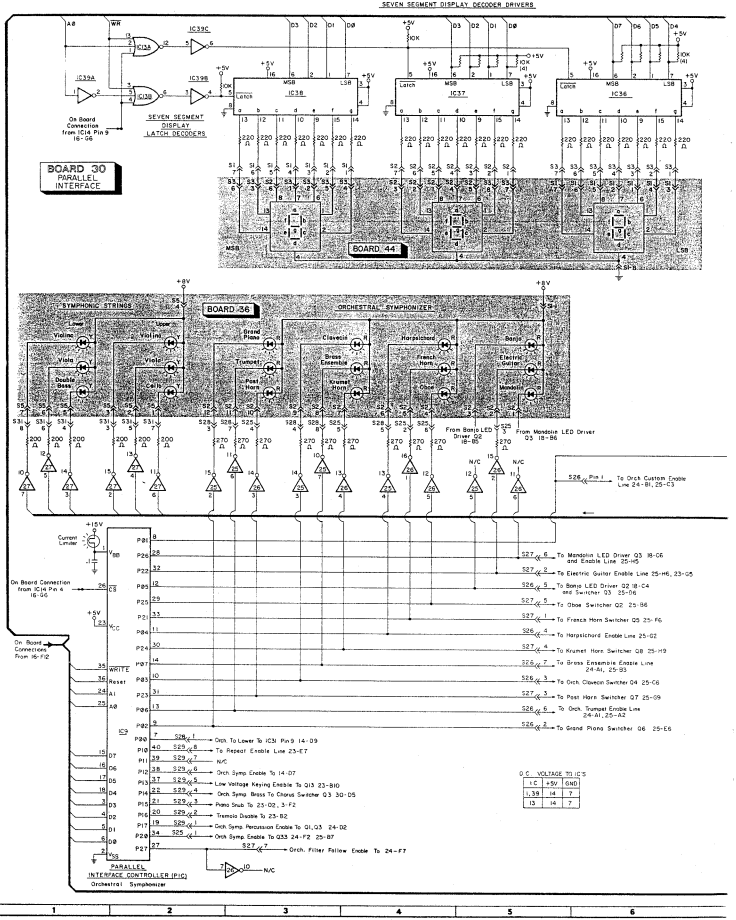

ORCHESTRAL PERCUSSION
BOARD 33
BOARD 30
PARALLEL INTERFACE
DIGITAL STEREO RHYTHM
BOARD 37
PARALLEL INTERFACE CONTROLLER (PIC)
PERCUSSION CONTROLLER
IC7 PARALLEL INTERFACE CONTROLLER (PIC)
Rhythm Display Control
CHIP SELECT DECODERS
INPUT DATA INVERTERS
IC15 TRUTH TABLE
D.C VOLTAGE TO IC'S
From Central Processing Unit (CPU) via 40 Lead Ribbon Cable (See Detail This Dwg. G12)
To/From Central Processing Unit (CPU) via 40 Lead Ribbon Cable 15-C6
Address From Central Processing Unit (CPU) via 40 Lead Ribbon Cable 15-E8
14 Lead Ribbon Cable To Rhythm 28-H8
To/From IC6 15-D4
To/From IC5 15-D4
To Rhythm PIC IC7 Pin 26 28-H9 Via 14 Lead Ribbon Cable
On Board Connection from IC6 Pin 40 See This Dwg. F4
On Board Connection from IC14 Pin 1 See This Dwg. F4
To Bd LED's This board
To Bd LED's Other boards
Snare/Downbeat Lamp Shown On Dwg B9
Current Limited
Current Limiter
Address From 15-E8

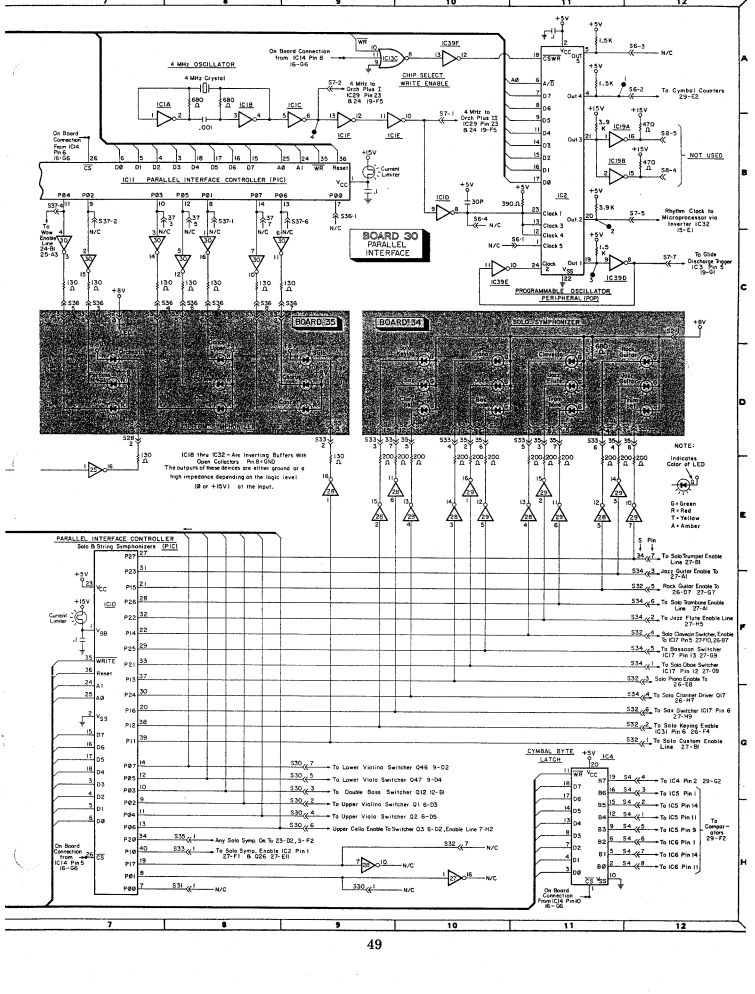
IC	+5V	GND
IC1,7	14	7

S	G	B	A	Outputs
1	X	X	X	High
X	0	X	X	High
0	1	0	0	O0
0	1	0	1	O1
0	1	1	0	O2
0	1	1	1	O3

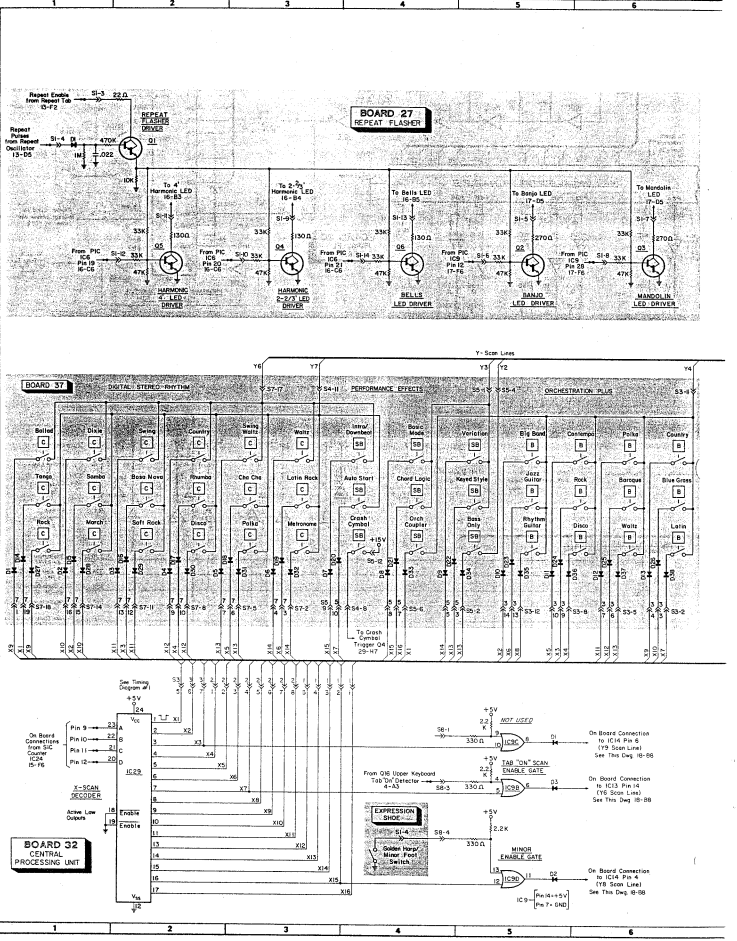

GOLDEN HARP
BOARD 30 PARALLEL INTERFACE
TAB PANEL
CANCEL ACCOMP
BOARD 38
SYMPHONIC BASS
Piano
Bass Fiddle
Tuba
ICII PARALLEL INTERFACE CONTROLLER (PIC)
Part Of IC11 Shown On Dwg 17
BOARD 37
ORCHESTRATION PLUS
PERFORMANCE EFFECTS
IC1B thru IC3Z
Are Inverting Buffers With Open Collectors Pin 8=Gnd
The Outputs of these devices
are either Ground or a high impedance
depending on the logic level (0 or +15V) at the input.
Mandolin Sustain Enable To Q23
Magic Memory Enable To 18-H7
Current Lumey +15V
IC8 PARALLEL INTERFACE CONTROLLER (PIC)
Orch Plus Display Control
On Board Connections To 17-F1
Orch Sym: Golden Harp Enable To IC3I Pin6 16-D9
Golden Harp Enable To 14-A1
PARALLEL INTERFACE CONTROLLER (PIC)
Function Switches
Current Lumey
Slow Attack Enable To 26-D9
Percussion Envelope to Pulse Keyer Enable To IC5 Pin6 26-C9
Solo Custom Percussion Enable To 26-C7
Pulse Width Modulation Enable To 26-B10
Sax, Oboe, Bassoon Pulse Shift Enable To 26-C10
N/C
Solo to Chorus Enable To 30-D5
To Vibrato Depth Switcher Q2 26-C3
Vibrato Disable To 26-B1
N/C
Solo Sustain Enable To 23-F2
Solo Filter Tracking Select 27-C7
Slow Attack Envelope to Keying Envelope Modulator Enable 26-G8
Percussion Envelope to Keying Envelope Modulator Enable 26-F8
N/C
N/C
Orch Plus To IC2-B1
Rhythm Off To 28-G12
To Orch. Plus Audio Enable Switches 30-D1
To Orch. Plus Audio Enable Switches 30-A4
Intro Latch To 28-G2
Vibrato Cancel To Q1 3-D3
Trap Reset To IC4 Pin13 29-H3
Cymbal Counter Power On Reset To 29-B1
40 LEAD RIBBON CABLE TERMINATIONS
Top of Board

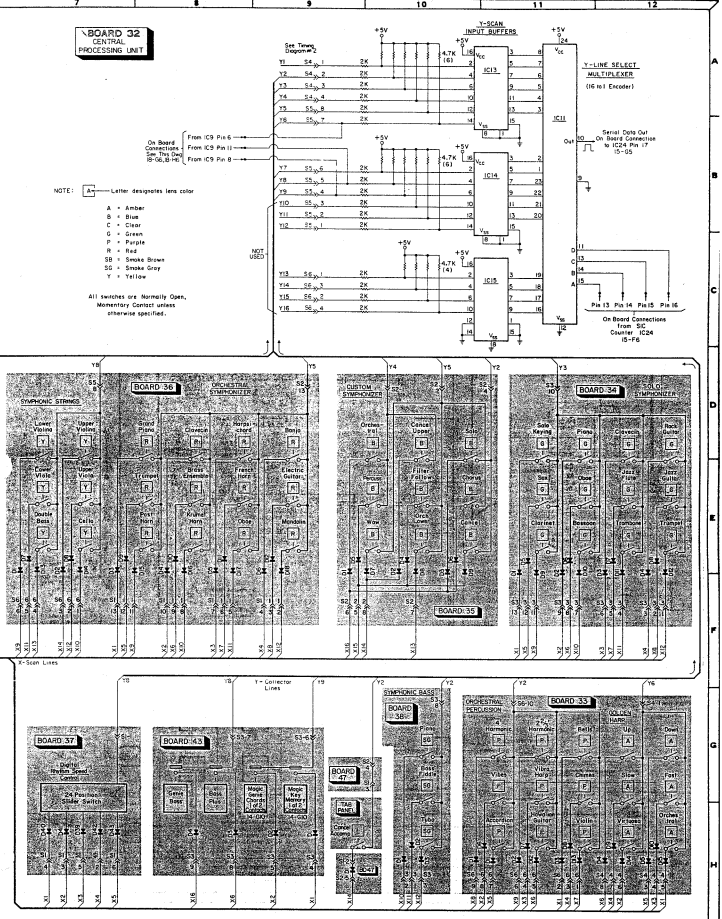
PARALLEL INTERFACE II



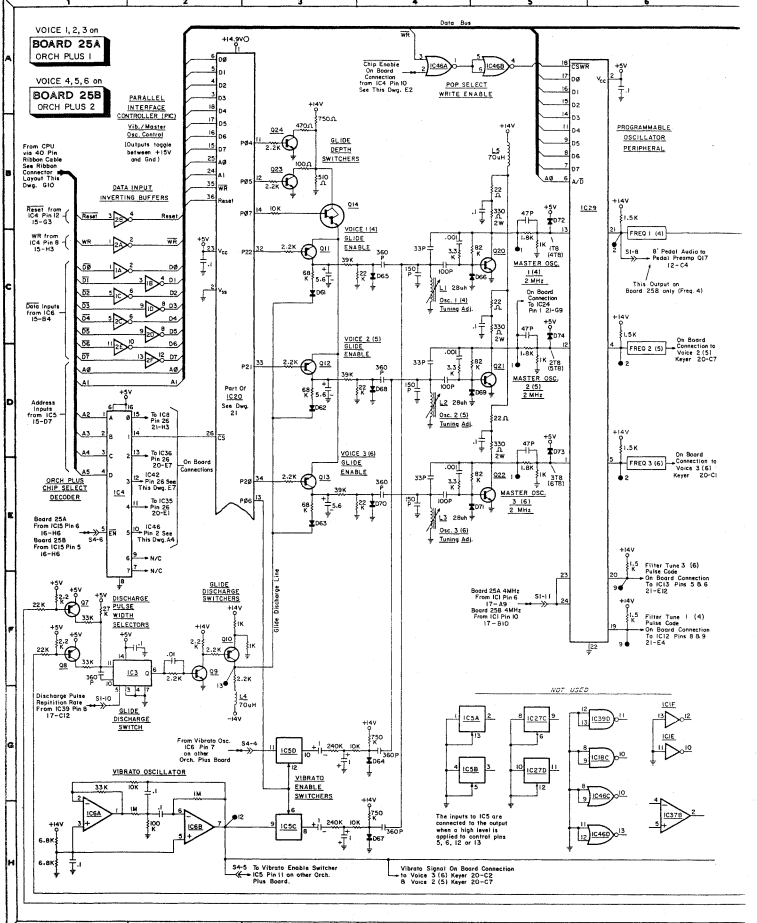

4 MHz OSCILLATOR
4 MHz Crystal
IC11 PARALLEL INTERFACE CONTROLLER (PIC)
BOARD 30
PARALLEL
INTERFACE
PROGRAMMABLE OSCILLATOR
PERIPHERAL (POP)
BOARD 35
BOARD 34
SOLOIST-1 MONITOR
PARALLEL INTERFACE CONTROLLER
Solo 8 String Symphonizers (PIC)
CYMBAL BYTE LATCH
IC16 thru IC32 = Are Inverting Buffers With Open Collectors Pin 8=GND
The outputs of these devices are either ground or a high impedance depending on the logic level (0 or +15V) at the input.
NOTE:
Indicates Color of LED
G = Green
R = Red
T = Yellow
A = Amber
To Solo Trumpet Enable Line 27-01
Jazz Guitar Enable To 27-AJ
Rock Guitar Enable To 26-07 27-07
To Solo Trombone Enable Line 27-AI
To Jazz Flute Enable Line 27-HS
Solo Chorus Switcher, Enable To IC17 Pin5 27-FO,26-07
To Stereson Switcher IC17 Pin 13 27-09
To Solo Oboe Switcher IC17 Pin 12 27-09
To Solo Piano Enable To 26-EB
To Solo Clarinet Driver Q17 26-HF
To Sax Switcher IC17 Pin 6 27-HD
To Solo Keyoing Enable IC31 Pin 6 26-14
To Solo Custom Enable Line 27-BI
To Lower Violins Switcher Q46 9-D2
To Lower Viola Switcher Q47 9-D4
To Double Bass Switcher Q12 12-B1
To Upper Violins Switcher Q1 6-D3
To Upper Viola Switcher Q2 6-D5
Upper Cello Enable To Switcher Q3 5-D2, Enable Line 7-H2
Any Solo Symp. On To 23-D2, 3-F2
To Solo Symp. Enable IC12 Pin1 27-FF & Q26 27-EI
To IC4 Pin 2 29-G2
To IC5 Pin 1
To IC5 Pin 14
To IC5 Pin 11
To IC5 Pin 9
To IC6 Pin 1
To IC6 Pin 14
To IC6 Pin 11
To Compositors 29-F2
On Board Connection From IC14 Pin 5 16-G6
On Board Connection From IC14 Pin 8 16-G6
On Board Connection From IC4 Pin 5 16-G6
On Board Connection From IC4 Pin10 16-G6
To Tone Enable Lines 24-B1 25-A3
To Glide Discharge Trigger 15-E3 & 19-J1
Rhythm Clock to Microprocessor via Inverter IC32 15-E1
To Synth Clock 24-A1
NOT USED
4 MHz to Osc Plus I IC29 Pin 23 & 24 19-F5
4 MHz to Osc Plus I
CHIP SELECT
WRITE ENABLE
On Board Connection from IC14 Pin 8 16-G6

LIGHTED BUTTON SCAN LOGIC

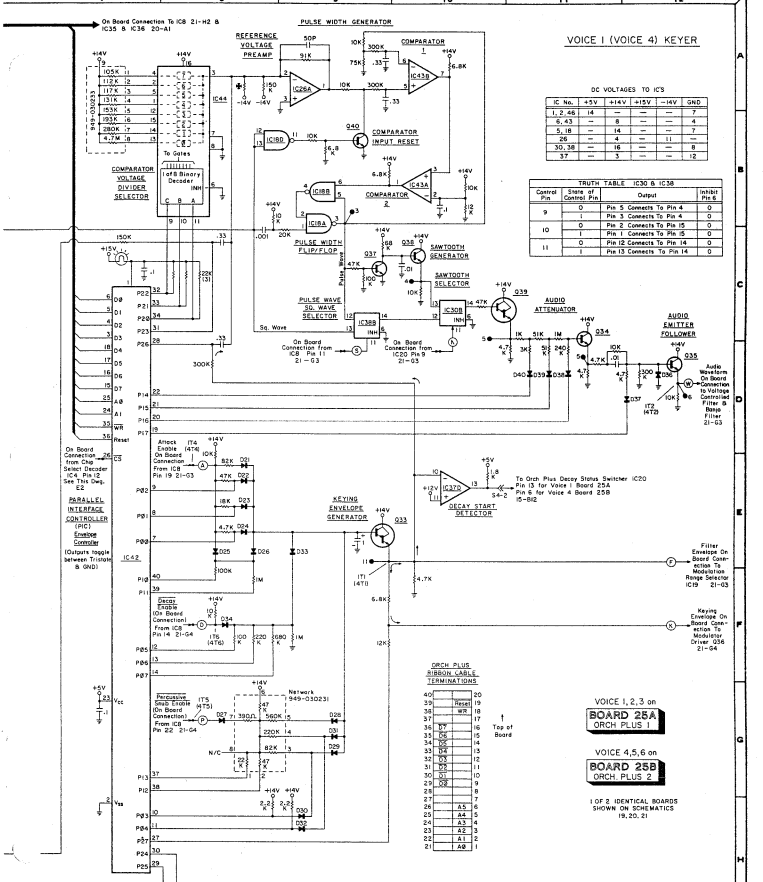



BOARD 32
CENTRAL PROCESSING UNIT
Y-SCAN INPUT BUFFERS
Y-LINE SELECT MULTIPLEXER
(16 to 1 Encoder)
Serial Data Out On Board Connection to IC24 Pin 17 15-05
On Board Connections from IC Counter IC24 15-F6
Pin 13 Pin 14 Pin15 Pin 16
On Board Connections From IC9 Pin 6
From IC9 Pin 11
From IC9 Pin 8
NOTE: A+ Letter designates lens color
A = Amber
B = Blue
C = Clear
G = Green
P = Purple
R = Red
SB = Smoke Brown
SG = Smoke Gray
Y = Yellow
All switches are Normally Open, Momentary Contact unless otherwise specified.
BOARD 36
BOARD 34
BOARD 35
BOARD 37
BOARD 143
BOARD 47
BOARD 38
BOARD 33
SYMPHONIC STRINGS
ORCHESTRAL SYMPHONIZER
CUSTOM SYMPHONIZER
SOLO SYMPHONIZER
SYMPHONIC BASS
ORCHESTRAL PERCUSSION
Y-Scan Lines
X-Scan Lines
Y-Collector Lines

ORCHESTRATION PLUS TONE GENERATOR & KEYER 1 (4)


VOICE 1, 2, 3 on
BOARD 25A
ORCH PLUS 1
VOICE 4, 5, 6 on
BOARD 25B
ORCH PLUS 2
PARALLEL INTERFACE CONTROLLER (PIC)
VIB./Master Osc. Control
(Outputs toggle between +15V and Gnd.)
From CPU via 40 Pin Ribbon Cable See Ribbon Connector Layout 1704 Dwg. 610
DATA INPUT INVERTING BUFFERS
Reset from IC4 Pin 17 I5-D3
WR from IC4 Pin 8 I5-H3
Data Inputs from IC6 I5-B4
Address Inputs from IC5 I5-D7
ORCH PLUS CHIP SELECT DECODER
Board 25A From IC15 Pin 6 I6-H6
Board 25B From IC15 Pin 5 I6-H6
S4-6
To IC8 Pin 26 21-H3
To IC36 Pin 26 20-E3
IC45 Pin 26 See This Dwg. C7
To IC35 Pin 26 20-E1
IC46 Pin 2 See This Dwg. A4
On Board Connections
Data Bus
WR
Chip Enable On Board Connection from IC4 Pin 10 See This Dwg. E2
IC36A
IC45B
POP SELECT WRITE ENABLE
PROGRAMMABLE OSCILLATOR PERIPHERAL
GLIDE DEPTH SWITCHES
VOICE 1 (4) SLIDE ENABLE
VOICE 2 (5) SLIDE ENABLE
VOICE 3 (6) SLIDE ENABLE
MASTER OSC. 1 (4) 2 MHz
MASTER OSC. 2 (5) 2 MHz
MASTER OSC. 3 (6) 2 MHz
Osc. 1 (4) Tuning Adj.
Osc. 2 (5) Tuning Adj.
Osc. 3 (6) Tuning Adj.
On Board Connection To IC24 Pin 1 D1-G9
FREQ 1 (4)
FREQ 2 (5)
FREQ 3 (6)
SI-8 8' Pedal Audio to Pedal Preamp Q17 I2-C4
This Output on Board 25B only (Freq. 4)
On Board Connection to Voice 2 (5) Keyer 20-C7
On Board Connection to Voice 3 (6) Keyer 20-C1
Board 25A 4MHz From IC1 Pin 6 I7-B8
Board 25B 4MHz From IC1 Pin 10 I7-B10
SI-11
Filter Tune 3 (6) Pulse Code On Board Connection To IC13 Pins 5 & 6 21-E12
Filter Tune 1 (4) Pulse Code On Board Connection To IC12 Pins 8 & 9 21-C4
Part Of IC26 See Dwg. 21
GLIDE DISCHARGE SWITCHES
Glide Discharge Line
GLIDE DISCHARGE PULSE WIDTH SELECTORS
GLIDE DISCHARGE SWITCH
Discharge Pulse Repitition Rate From IC39 Pin 5 I7-C12
SI-10
From Vibrato Osc. IC6 Pin 7 On other Orch. Plus Board
S4-4
VIBRATO OSCILLATOR
VIBRATO ENABLE SWITCHES
S4-5 To Vibrato Enable Switcher IC5 Pin 11 on other Orch. Plus Board.
Vibrato Signal On Board Connection to Voice 3 (6) Keyer 20-C2 & Voice 2 (5) Keyer 20-C7
NOT USED
The inputs to IC5 are connected to the output when a high level is applied to control pins 5, 6, 12, or 13

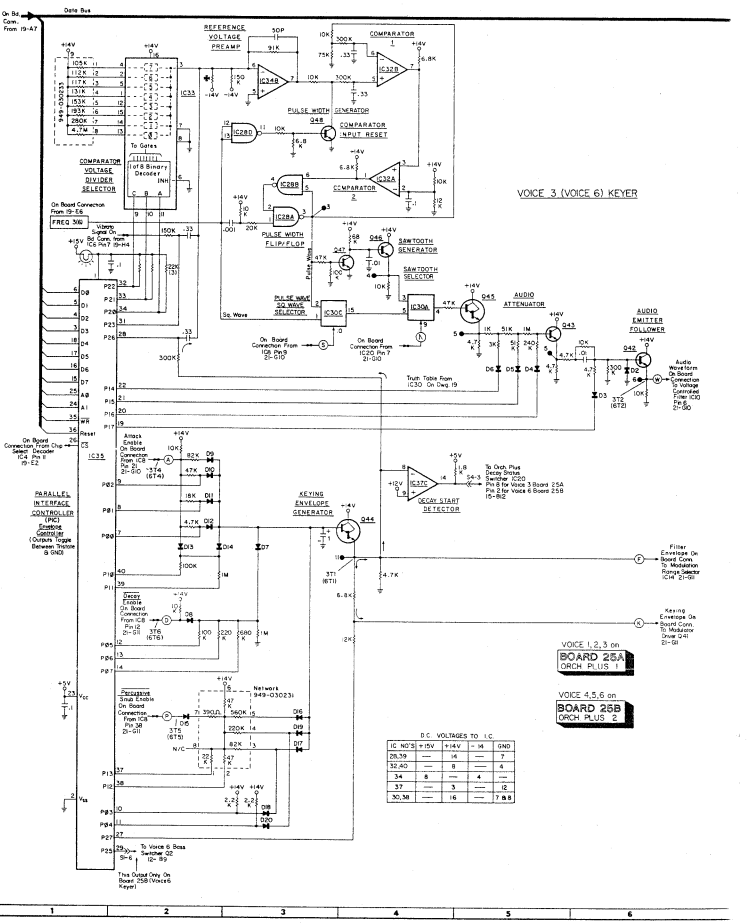
ORCHESTRATION PLUS TONE GENERATOR & KEYER 1 (4)

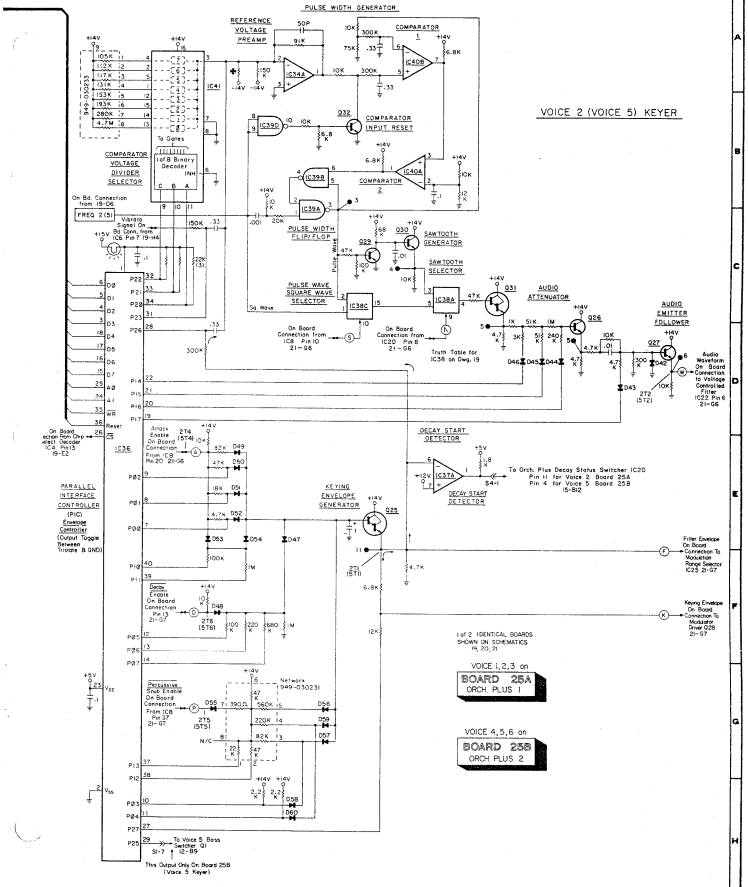

VOICE I (VOICE 4) KEYER
PULSE WIDTH GENERATOR
REFERENCE VOLTAGE PREAMP
COMPARATOR
COMPARATOR INPUT RESET
COMPARATOR VOLTAGE DIVIDER SELECTOR
1 of 8 Binary Decoder
PULSE WIDTH FLIP/FLOP
SAWTOOTH GENERATOR
SAWTOOTH SELECTOR
PULSE WAVE SQ. WAVE SELECTOR
AUDIO ATTENUATOR
AUDIO EMITTER FOLLOWER
KEYING ENVELOPE GENERATOR
DECAY START DETECTOR
PARALLEL INTERFACE CONTROLLER (PIC)
Envelope Controller
ORCH. PLUS RIBBON CABLE TERMINATIONS
VOICE 1, 2, 3 on BOARD 25A ORCH PLUS
VOICE 4,5,6 on BOARD 25B ORCH. PLUS 2
1 OF 2 IDENTICAL BOARDS SHOWN ON SCHEMATICS 19, 20, 21
DC VOLTAGES TO IC'S
TRUTH TABLE IC30 & IC38

IC No.	+5V	+14V	+15V	-14V	GND
1, 2, 45	14	—	—	—	7
6, 43	—	8	—	—	4
5, 18	—	14	—	—	7
26	—	4	—	11	—
30, 38	—	16	—	—	8
37	—	3	—	—	12

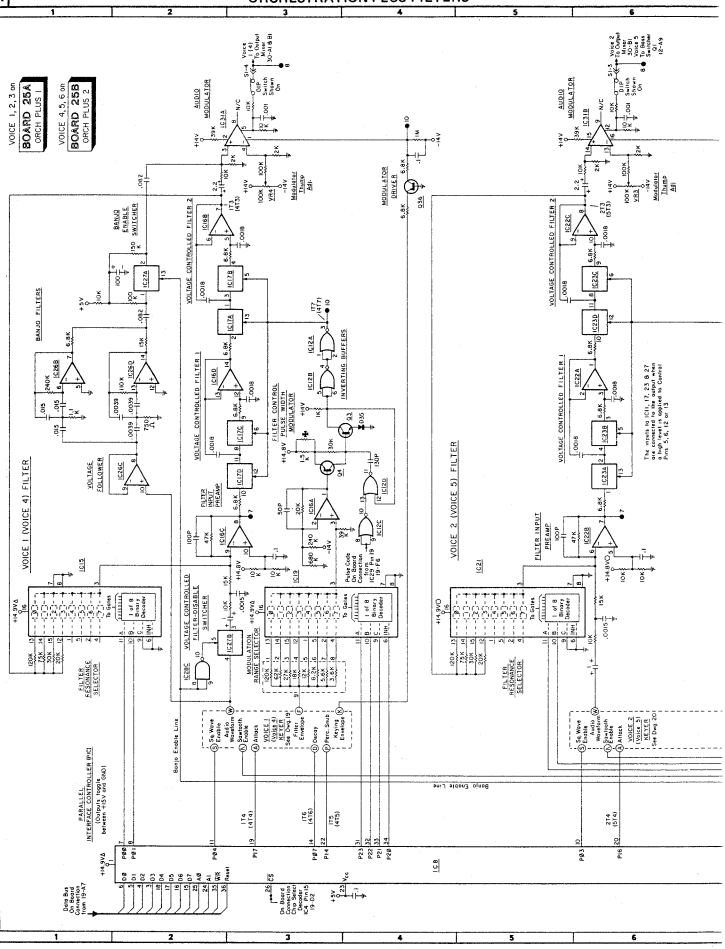
Control Pin	State of Control Pin	Output	Inhibit Pin 6
9	0	Pin 5 Connects To Pin 4	0
	1	Pin 3 Connects To Pin 4	0
10	0	Pin 2 Connects To Pin 15	0
	1	Pin 1 Connects To Pin 15	0
11	0	Pin 12 Connects To Pin 14	0
	1	Pin 13 Connects To Pin 14	0

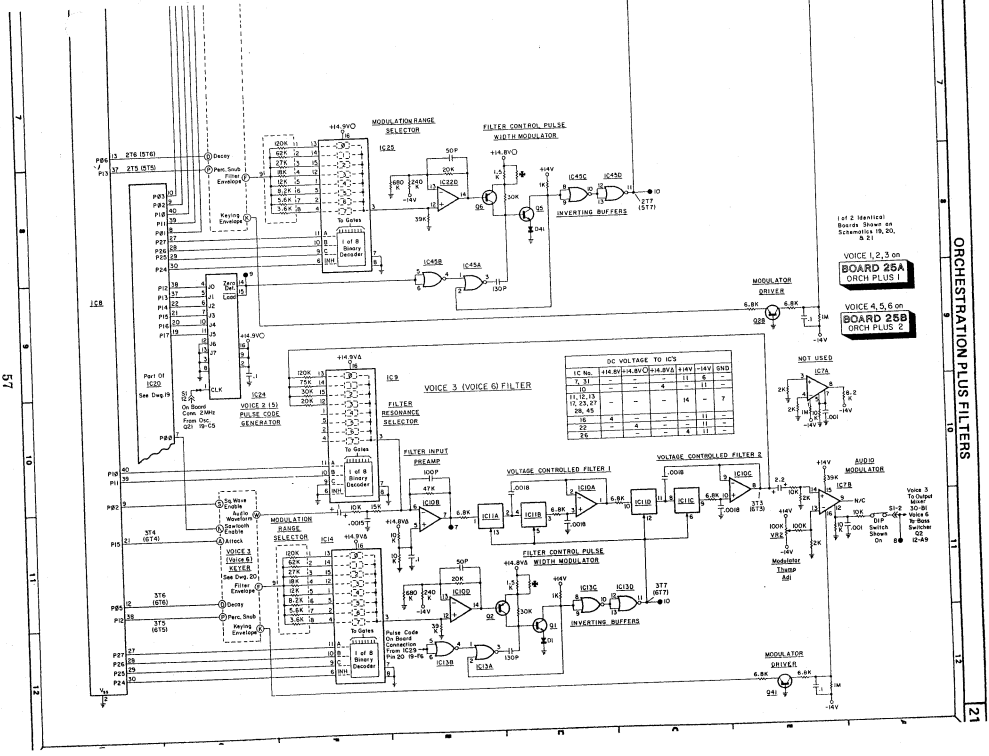
ORCHESTRATION PLUS KEYER 2 (5), 3 (6)

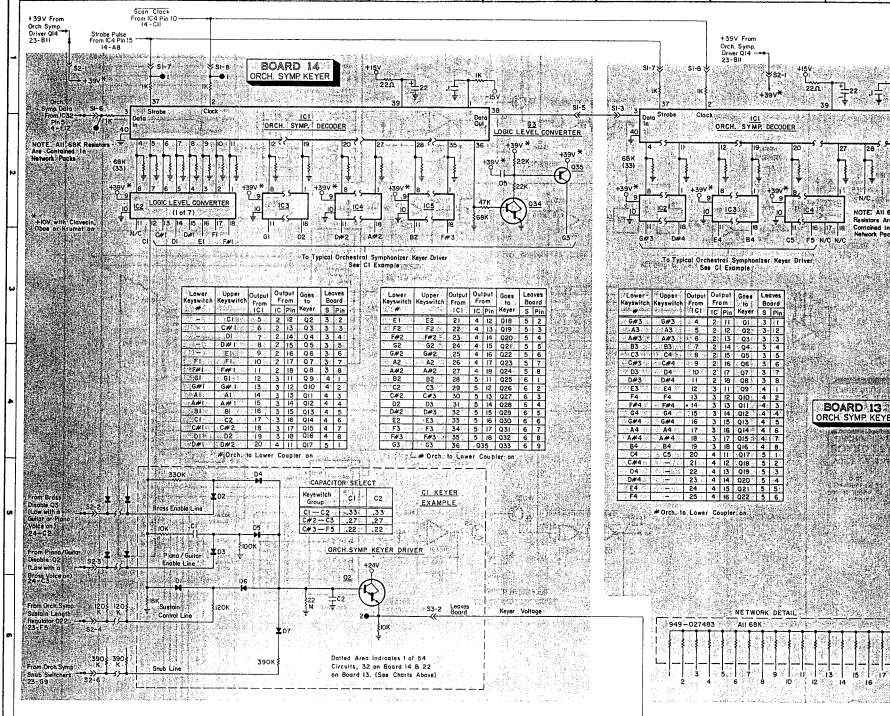

VOICE 3 (VOICE 6) KEYER
REFERENCE VOLTAGE PREAMP
COMPARATOR
PULSE WIDTH GENERATOR
COMPARATOR INPUT RESET
COMPARATOR VOLTAGE DIVIDER SELECTOR
PULSE WIDTH FLIP/FLOP
SAWTOOTH GENERATOR
SAWTOOTH SELECTOR
PULSE WAVE SQ WAVE SELECTOR
AUDIO ATTENUATOR
AUDIO EMITTER FOLLOWER
KEYING ENVELOPE GENERATOR
DECAY START DETECTOR
PARALLEL INTERFACE CONTROLLER (PIC)
Data Bus
VOICE 1, 2, 3 on BOARD 25A ORCH PLUS 1
VOICE 4,5,6 on BOARD 25B ORCH PLUS 2
D.C. VOLTAGES TO I.C.
IC NO'S | +15V | +14V | -14 | GND
20,39 | — | 14 | — | 7
32,40 | — | 8 | — | 4
34 | 8 | — | 4 | —
37 | — | 3 | — | 12
30,38 | — | 16 | — | 7 & 8


PULSE WIDTH GENERATOR
REFERENCE VOLTAGE PREAMP
COMPARATOR
COMPARATOR INPUT RESET
COMPARATOR VOLTAGE DIVIDER SELECTOR
PULSE WIDTH FLIP/FLOP
SAWTOOTH GENERATOR
SAWTOOTH SELECTOR
PULSE WAVE SQUARE WAVE SELECTOR
AUDIO ATTENUATOR
AUDIO EMITTER FOLLOWER
DECAY START DETECTOR
KEYING ENVELOPE GENERATOR
PARALLEL INTERFACE CONTROLLER (PIC)
VOICE 2 (VOICE 5) KEYER
VOICE 1,2,3 on BOARD 25A ORCH. PLUS 1
VOICE 4,5,6 on BOARD 25B ORCH. PLUS 2
1 of 2 IDENTICAL BOARDS SHOWN ON SCHEMATICS PL 20, 21
This Output Only On Board 25B (Voice 5 Keyer)

ORCHESTRATION PLUS FILTERS


VOICE 1, 2, 3 on
BOARD 25A
ORCH PLUS 1
VOICE 4, 5, 6 on
BOARD 25B
ORCH PLUS 2
VOICE 1 (VOICE 4) FILTER
VOICE 2 (VOICE 5) FILTER
BAND FILTERS
VOLTAGE CONTROLLED FILTER 1
VOLTAGE CONTROLLED FILTER 2
FILTER CONTROL PULSE WIDTH MODULATOR
VOLTAGE CONTROLLED FILTERSWEEP
FILTER SWEEP FREQUENCY
FILTER INPUT PREAMP
FILTER RESONANCE SELECTION
VOICE CONTROLLED FILTERSWEEP
FILTER BAND SELECTOR
BAND ENABLE
BAND MODULATOR
MODULATOR DRIVER
VOLTAGE FOLLOWER
Band Enable Line
PARALLEL INTERFACE CONTROLLER (PIC) Bandwidth Control Outputs (Inputs from Keyboard)
Data Bus On Board Data Bus from 19-27
On Board Chip Select Line
To Voice 1 Audio Output Switch
To Voice 2 Audio Output Switch
To Voice 3 Audio Output Switch
To Voice 4 Audio Output Switch
To Voice 5 Audio Output Switch
To Voice 6 Audio Output Switch
To Voice 1 Filter Output
To Voice 2 Filter Output
To Voice 3 Filter Output
To Voice 4 Filter Output
To Voice 5 Filter Output
To Voice 6 Filter Output
To Voice 1 Filter Input
To Voice 2 Filter Input
To Voice 3 Filter Input
To Voice 4 Filter Input
To Voice 5 Filter Input
To Voice 6 Filter Input
To Voice 1 Output Switch
To Voice 2 Output Switch
To Voice 3 Output Switch
To Voice 4 Output Switch
To Voice 5 Output Switch
To Voice 6 Output Switch
To Mod Switch
To Band Enable Switch
To Mod Switch
To Band Enable Switch
To Voice 1 Output Switch
To Voice 2 Output Switch
To Voice 3 Output Switch
To Voice 4 Output Switch
To Voice 5 Output Switch
To Voice 6 Output Switch
To Mod Switch
To Band Enable Switch
To Mod Switch
To Band Enable Switch
The inputs to CD4,17, 23 & 27 are shown with a 10K pullup and a 4.7pF filter capacitor to Ground. Pins 4, 6, 12 & 13

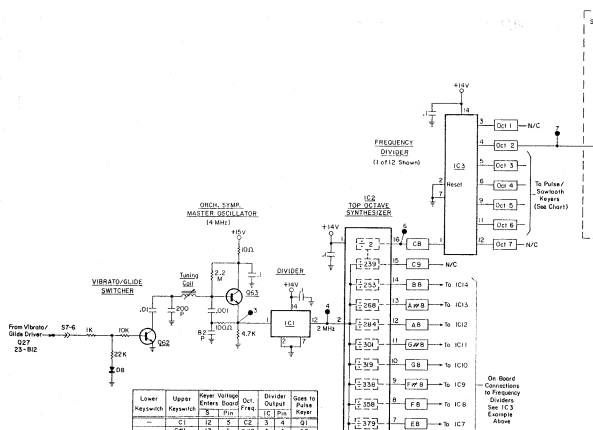

ORCHESTRATION PLUS FILTERS
21
57
VOICE 3 (VOICE 6) FILTER
DC VOLTAGE TO IC's
IC No. | +16.8V | +14.8V | +14.9V | -14V | GND
7, 31 | - | - | - | 11 | 6
15 | - | - | 4 | - | 11
11, 12, 13
17, 23, 27
28, 45 | - | - | 14 | - | 7
16 | 4 | - | - | 11 | -
22 | - | - | - | 11 | -
26 | - | - | 4 | 11 | -
MODULATION RANGE SELECTOR
FILTER CONTROL PULSE WIDTH MODULATOR
INVERTING BUFFERS
FILTER RESONANCE SELECTOR
FILTER INPUT PREAMP
VOLTAGE CONTROLLED FILTER 1
VOLTAGE CONTROLLED FILTER 2
MODULATOR DRIVER
AUDIO MODULATOR
NOT USED
Modulator Thump Adj
1 of 2 Identical Boards Shown on Schematics 19, 20, & 21
VOICE 1, 2, 3 on BOARD 25A ORCH PLUS 1
VOICE 4, 5, 6 on BOARD 25B ORCH PLUS 2
Voice 3 To Output 3O-IN
Voice 6 To Bass Switcher Q2 I2-A9
Pulse Code On Board Connection From IC29 Pin 20 I9-F6
On Board Conn. 2MHz From Osc. Q21 I9-C5
Part Of IC20 See Dwg.19
VOICE 2 (5) PULSE CODE GENERATOR
Keying Envelope
Filter Envelope
Decay
Perc. Snub
Zero Det. Loop
1 of 8 Binary Decoder
To Gates
Audio Waveform
Bandwidth Enable
Attack
Gate Enable
VOICE 3 (VOICE 6) KEYER
See Dwg. 20
IC8
IC9
IC14
IC24
IC25
IC26
IC27
IC28
IC29
IC30
IC31
IC32
IC33
IC34
IC35
IC36
IC37
IC38
IC39
IC40
IC41
IC42
IC43
IC44
IC45
Q1
Q2
Q8
Q28
Q41
Q49
Q94


BOARD 14
ORCH. SYMP KEYER
ORCH. SYMP. DECODER
LOGIC LEVEL CONVERTER
+39V From Orch. Symp. Driver Q#4 23-B11
Strobe Pulse From IC4 Pin 15 I4-A8
Scan Clock From IC4 Pin 10 I4-C11
+39V From Orch. Symp. Driver Q#4 23-B11
Orch. Symp. Data In From I/O 23-F10
Data Out
Strobe
Clock
NOTE: All 68K Resistors Are Contained In Network Packs
+39V with Clavichord, Oboe or Klarinet on
To Typical Orchestral Symphonizer Keyer Driver
See C1 Example
Orch. to Lower Coupler on
CAPACITOR SELECT
Keyswitch Group
C1
C2
C1 KEYER EXAMPLE
Brass Enable Line
Piano / Guitar Enable Line
Flute Sustain / Carried Line
Snub Line
Dotted Area Indicates 1 of 54 Circuits, 32 on Board 14 & 22 on Board 13. (See Charts Above)
Keyer Voltage
Leaves Board
NETWORK DETAIL
949-027483
All 68K
BOARD 13
ORCH. SYMP KEYER

Lower Keyswitch #	Upper Keyswitch #	Output From IC1	Output From IC Pin	Goes to Keyer	Leaves Board S	Leaves Board Pin
—	C1	5	2	Q2	3	2
—	C#1	6	2	I3	3	3
—	D1	7	2	I4	3	4
—	D#1	8	2	I5	3	5
—	E1	9	2	I6	3	6
—	F1	10	2	I7	3	7
F1	F#1	11	2	I8	3	8
B1	B1	12	3	I1	4	1
G#1	G#1	13	3	I2	2	10
A1	A1	14	3	I3	2	11
A#1	A#1	15	3	I4	2	12
B1	B1	16	3	I5	2	13
C1	C2	17	3	I6	2	14
C#1	C#2	18	3	I7	2	15
D1	D2	19	3	I8	2	16
D#1	D#2	20	4	I1	2	17

Lower Keyswitch #	Upper Keyswitch #	Output From IC1	Output From IC Pin	Goes to Keyer	Leaves Board S	Leaves Board Pin
E1	E2	21	4	I2	2	18
F2	F2	22	4	I3	2	19
F#2	F#2	23	4	I4	2	20
G2	G2	24	4	I5	2	21
G#2	G#2	25	4	I6	2	22
A2	A2	26	4	I7	2	23
A#2	A#2	27	4	I8	2	24
B2	B2	28	5	I1	2	25
C2	C3	29	5	I2	2	26
C#2	C#3	30	5	I3	2	27
D2	D3	31	5	I4	2	28
D#2	D#3	32	5	I5	2	29
E2	E3	33	5	I6	2	30
F3	F3	34	5	I7	2	31
F#3	F#3	35	5	I8	2	32
G3	G3	36	6	I1	2	33

Lower Keyswitch #	Upper Keyswitch #	Output From IC1	Output From IC Pin	Goes to Keyer	Leaves Board S	Leaves Board Pin
G#3	A#3	4	2	I1	3	1
A3	A3	5	2	I2	2	1
A#3	A#3	6	2	I3	2	2
B3	B3	7	2	I4	2	3
C3	C4	8	2	I5	2	4
C#3	C#4	9	2	I6	2	5
D3	D4	10	2	I7	2	6
D#3	D#4	11	2	I8	2	7
E3	E4	12	3	I1	2	8
F4	F4	13	3	I2	2	9
F#3	F#4	14	3	I3	2	10
G4	G4	15	3	I4	2	11
G#4	G#4	16	3	I5	2	12
A4	A4	17	3	I6	2	13
A#4	A#4	18	3	I7	2	14
B4	B4	19	3	I8	2	15
C4	C5	20	4	I1	2	16
C#4	—	21	4	I2	2	17
D4	—	22	4	I3	2	18
D#4	—	23	4	I4	2	19
E4	—	24	4	I5	2	20
F4	—	25	4	I6	2	21



SOCKET 15 OUTPUT CONNECTIONS

Lower Keyswitch Group	Octave Freq. Group	Upper Keyswitch Group	Octave Freq. Group	Pin A	Pin B
F1-B1	F2-B2	C1-B1	C2-B2	1	5
C1-B2	C3-B3	C2-B2	C3-B3	2	6
C2-B3	C4-B4	C3-B3	C4-B4	3	7
C3-F5	C5-F6	C4-C5	C5-C6	4	8

CAPACITOR SELECT

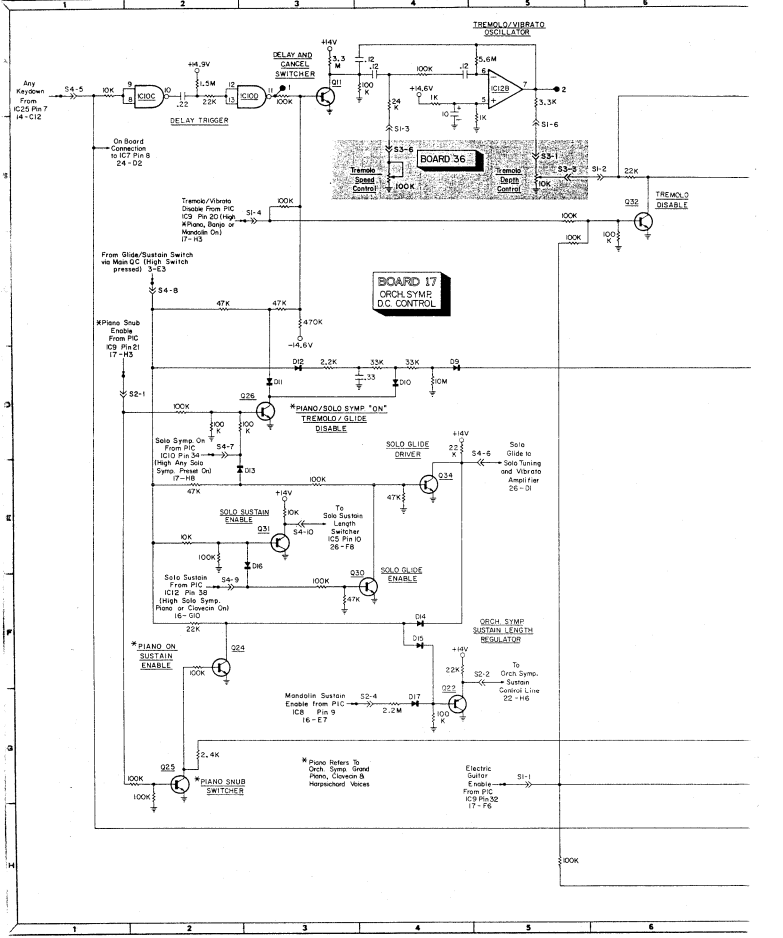
Pulse/Sawtooth Keyer Group	C3	C4
Q1-Q6	.00033	.15
Q7-Q12	.0012	.1
Q13-Q18	.0015	.068
Q19-Q24	.001	.047
Q25-Q30	750P	.033
Q31-Q36	500P	.022
Q37-Q42	360P	.015
Q43-Q54	250P	.01

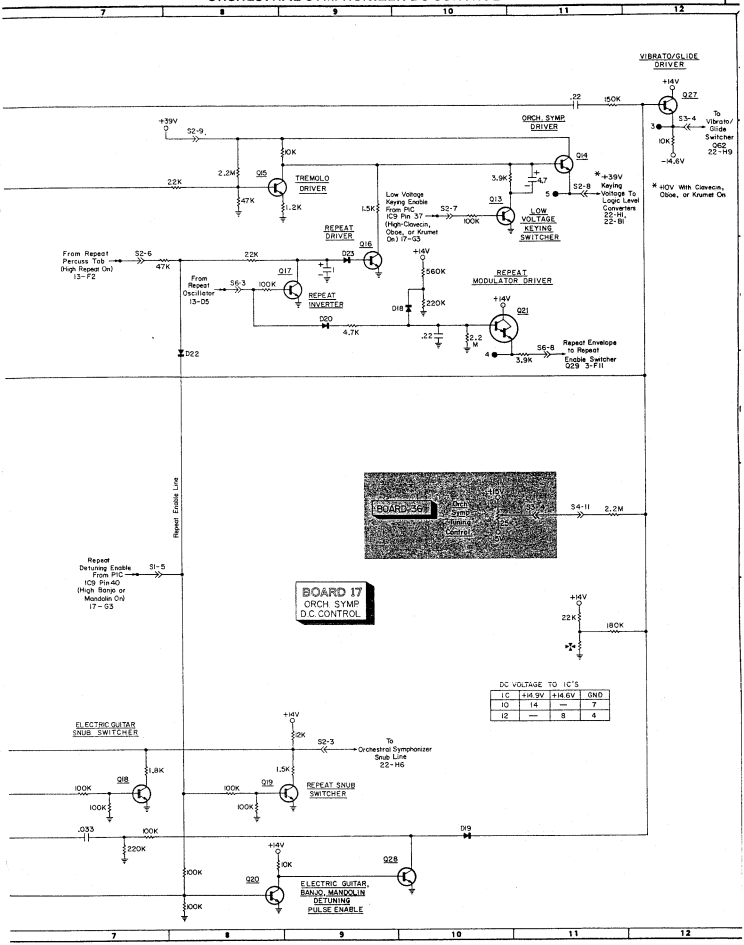
Lower Keyswitch	Upper Keyswitch	Keyer Voltage Enters Board		Oct. Freq.	Divider Output		Goes to Pulse Keyer
		S	Pin		IC	Pin	
—	C1	12	5	C2	3	4	Q1
—	C#1	13	5	C#2	4	4	Q2
—	D1	14	5	D2	5	4	Q3
—	D#1	1	5	D#2	6	4	Q4
—	E1	2	5	E2	7	4	Q5
F1	F1	3	5	F2	8	4	Q6
F#1	F#1	4	4	F#2	9	4	Q7
G1	G1	5	4	G2	10	4	Q8
G#1	G#1	6	4	G#2	11	4	Q9
A1	A1	9	4	A2	12	4	Q10
A#1	A#1	10	4	A#2	13	4	Q11
B1	B1	11	4	B2	14	4	Q12
C1	C2	12	4	C3	3	5	Q13
C#1	C#2	13	4	C#3	4	5	Q14
D1	D2	14	4	D3	5	5	Q15
D#1	D#2	1	4	D#3	6	5	Q16
E1	E2	2	4	E3	7	5	Q17
F2	F2	3	4	F3	8	5	Q18
F#2	F#2	4	3	F#3	9	5	Q19
G2	G2	5	3	G3	10	5	Q20
G#2	G#2	6	3	G#3	11	5	Q21
A2	A2	9	3	A3	12	5	Q22
A#2	A#2	10	3	A#3	13	5	Q23
B2	B2	11	3	B3	14	5	Q24
C2	C3	12	3	C4	3	6	Q25
C#2	C#3	13	3	C#4	4	6	Q26
D2	D3	14	3	D4	5	6	Q27
D#2	D#3	1	3	D#4	6	6	Q28
E2	E3	2	3	E4	7	6	Q29
F3	F3	3	3	F4	8	6	Q30
F#3	F#3	4	2	F#4	9	6	Q31
G3	G3	5	2	G4	10	6	Q32

Lower Keyswitch	Upper Keyswitch	Keyer Voltage Enters Board		Oct. Freq.	Divider Output		Goes to Pulse Keyer
		S	Pin		IC	Pin	
G#3	G#3	6	2	G#4	11	6	Q33
A3	A3	9	2	A4	12	6	Q34
A#3	A#3	10	2	A#4	13	6	Q35
B3	B3	11	2	B4	14	6	Q36
C3	C4	12	2	C5	3	9	Q37
C#3	C#4	13	2	C#5	4	9	Q38
D3	D4	14	2	D5	5	9	Q39
D#3	D#4	1	2	D#5	6	9	Q40
E3	E4	2	2	E5	7	9	Q41
F4	F4	3	2	F5	8	9	Q42
F#4	F#4	4	1	F#5	9	9	Q43
G4	G4	5	1	G5	10	9	Q44
G#4	G#4	6	1	G#5	11	9	Q45
A4	A4	9	1	A5	12	9	Q46
A#4	A#4	10	1	A#5	13	9	Q47
B4	B4	11	1	B5	14	9	Q48
C4	C5	12	1	C6	3	11	Q49
C#4	—	13	1	C#6	4	11	Q50
D4	—	14	1	D6	5	11	Q51
D#4	—	1	1	D#6	6	11	Q52
E4	—	2	1	E6	7	11	Q53
F5	—	3	1	F6	8	11	Q54

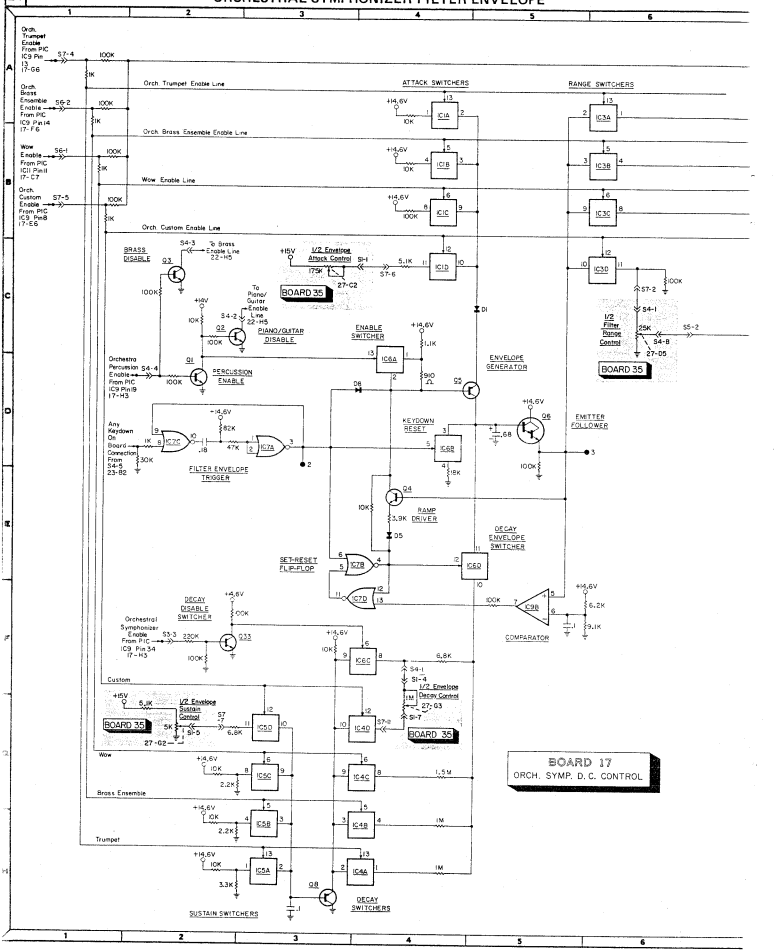
BOARD 16
ORCH. SYMP. TONE GEN.

ORCHESTRAL SYMPHONIZER DC CONTROL

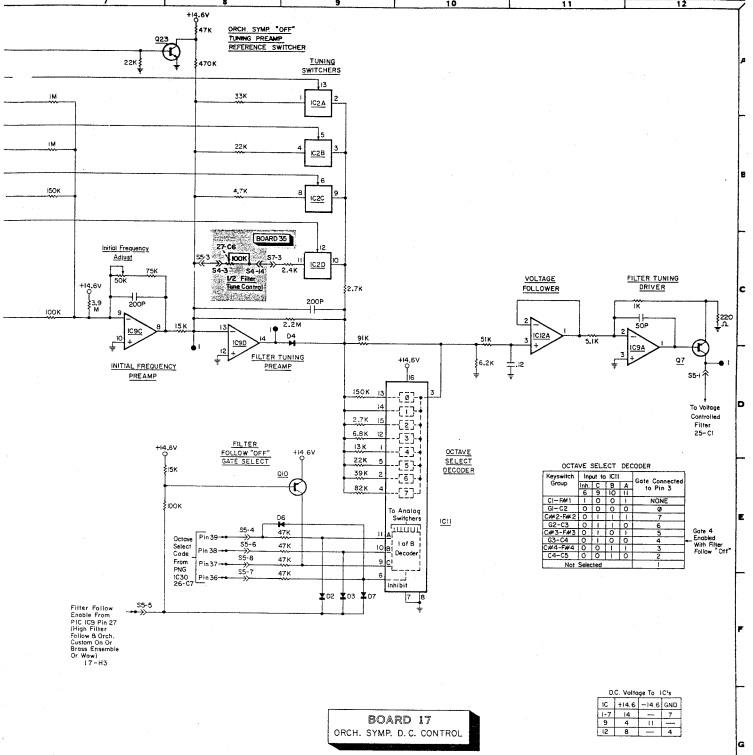

TREMOLO/VIBRATO OSCILLATOR
DELAY AND CANCEL SWITCHER
DELAY TRIGGER
Any Keydown From IC25 Pin 7 I4-C12
On Board Connection to IC7 Pin 8 24-D2
BOARD 36
Tremolo Speed Control
Tremolo Depth Control
Tremolo/Vibrato Disable From PIC IC9 Pin 20 (High = Piano, Banjo or Mandolin On) I7-H3
TREMOLO DISABLE
From Glide/Sustain Switch via Main QC (High Switch pressed) 3-E3
BOARD 17
ORCH. SYMP. DC CONTROL
*Piano Snub Enable From PIC IC9 Pin 21 I7-H5
*PIANO/SOLO SYMP "ON" TREMOLO/GLIDE DISABLE
Solo Symp. On From PIC IC10 Pin 34 (High Any Solo Symp. Preset On) I7-H8
SOLO GLIDE DRIVER
Solo Glide to Solo Tuning and Vibrato Amplifier 26-D1
SOLO SUSTAIN ENABLE
To Solo Sustain Length Switcher IC5 Pin 10 26-F8
Solo Sustain From PIC IC12 Pin 38 (High Solo Symp. Piano or Clavecin On) I6-G10
SOLO GLIDE ENABLE
ORCH. SYMP SUSTAIN LENGTH REGULATOR
*PIANO ON SUSTAIN ENABLE
To Orch. Symp. Sustain Control Line 22-H6
Mandolin Sustain Enable from PIC IC8 Pin 9 I6-E7
*PIANO SNUB SWITCHER
*Piano Refers To Orch. Symp. Grand Piano, Clavecin & Harpsichord Voices
Electric Guitar Enable From PIC IC9 Pin 32 I7-F6


ORCHESTRAL SYMPHONIZER DC CONTROL
VIBRATO/GLIDE DRIVER
ORCH SYMP DRIVER
TREMOLO DRIVER
LOW VOLTAGE KEYING SWITCHER
REPEAT DRIVER
REPEAT INVERTER
REPEAT MODULATOR DRIVER
REPEAT SNUB SWITCHER
ELECTRIC GUITAR, BANJO, MANDOLIN DETUNING PULSE ENABLE
ELECTRIC GUITAR SNUB SWITCHER
BOARD 36
BOARD 17
ORCH SYMP D.C. CONTROL
Repeat Enable Line
To Vibrato/Glide Switcher 062 22-H9
To Orchestral Symphonizer Snub Line 22-H6
Repeat Envelope to Repeat Enable Switcher 029 3-F11
From Repeat Percuss Tab (High Repeat On) 13-F2
From Repeat Oscillator 13-D5
Repeat Detuning Enable From PIC IC9 Pin 40 (High Banjo or Mandolin On) 17-G3
Low Voltage Keying Enable From PIC IC9 Pin 37 (High-Clavecin, Oboe, or Krumet On) 17-G3
*+39V Keying Voltage To Logic Level Converters 22-H1, 22-B1
* +10V With Clavecin, Oboe, or Krumet On
DC VOLTAGE TO IC'S
IC | +14.9V | +14.6V | GND
10 | 14 | — | 7
12 | — | 8 | 4

ORCHESTRAL SYMPHONIZER FILTER ENVELOPE



ORCHESTRAL SYMPHONIZER FILTER ENVELOPE



OCTAVE SELECT DECODER

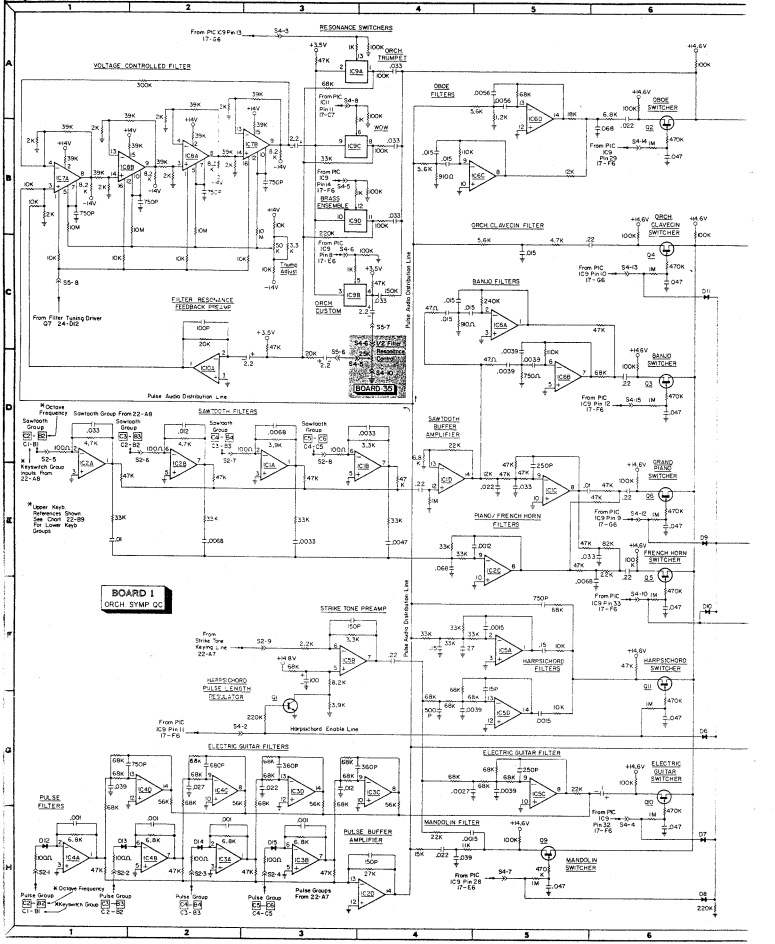
Keyswitch Group	Input to IC11				Gate Connected to Pin 3
	Inh 6	C 9	B 10	A 11	
C1–FA1	1	0	0	1	NONE
G–G2	0	0	0	0	9
G#2–F#2	0	1	1	1	7
G2–C3	0	1	1	0	6
G#3–F#3	0	1	0	1	5
G3–C4	0	1	0	0	4
G#4–F#4	0	0	1	1	3
G4–C5	0	0	1	0	2
Not Selected					1

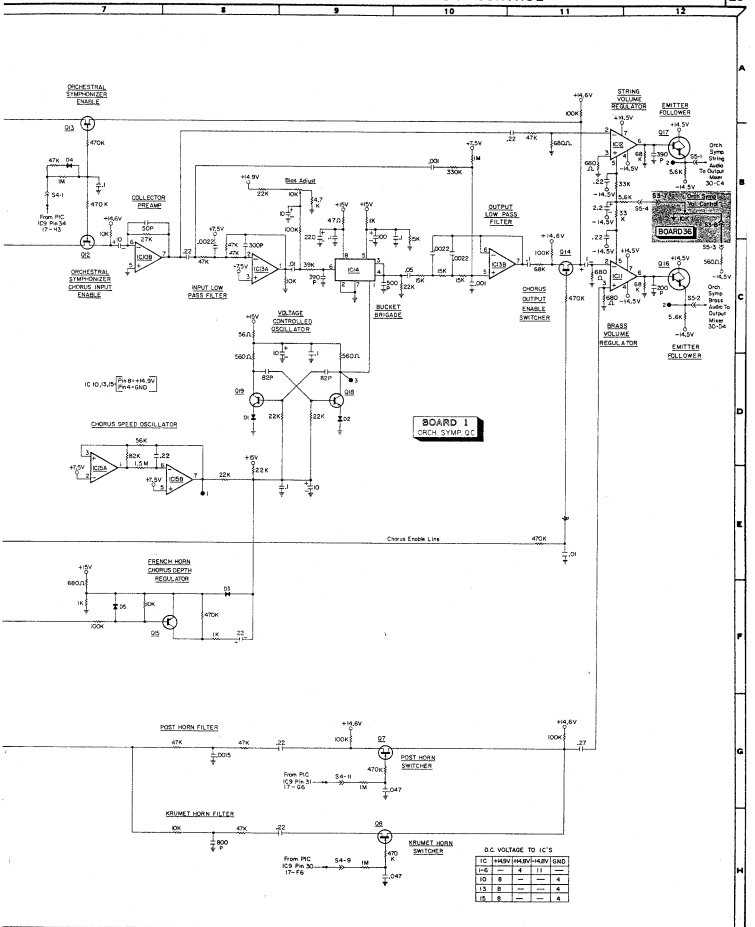
D.C. Voltage To IC's

IC	+14.6	−14.6	GND
1–7	14	—	7
9	4	11	—
12	8	—	4

BOARD 17
ORCH. SYMP. D.C. CONTROL

ORCHESTRAL SYMPONIZER QUALITY CONTROL

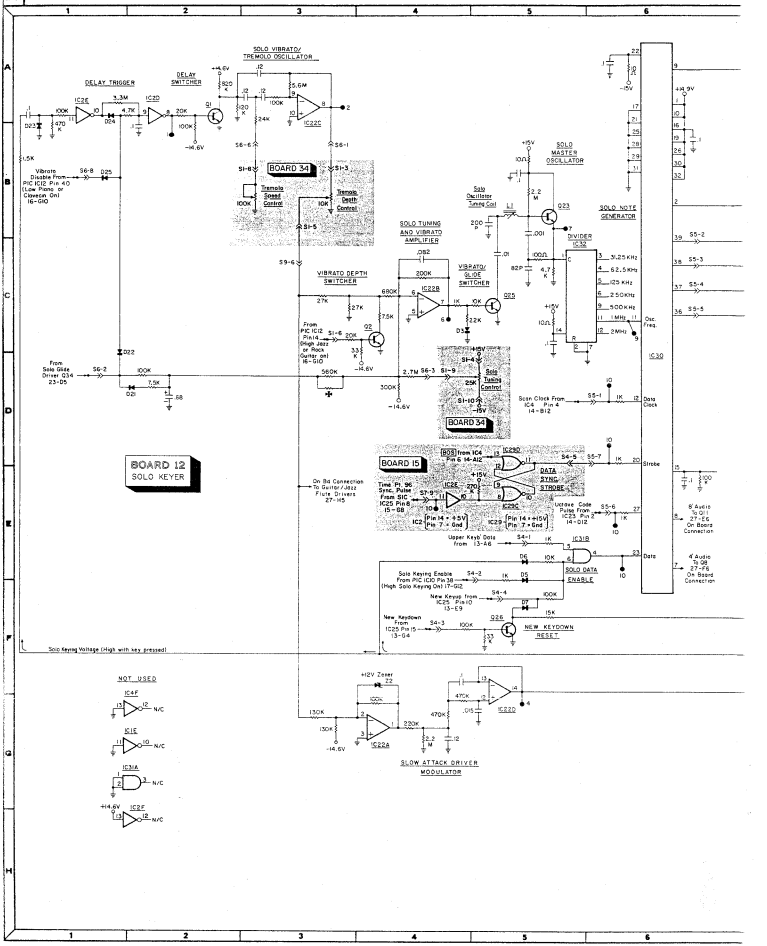


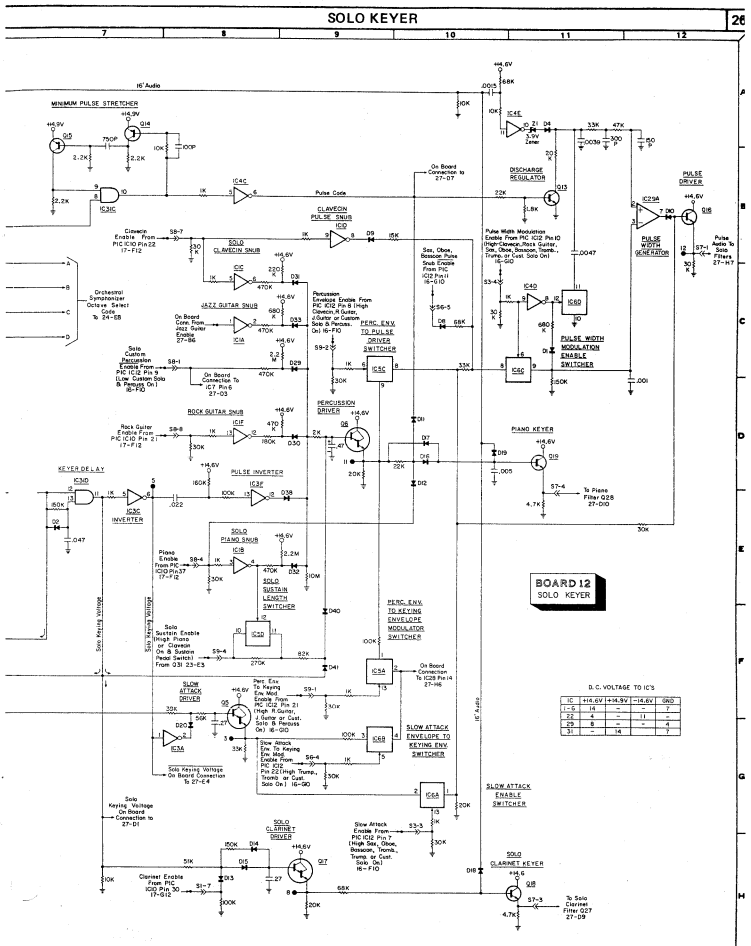


D.C. VOLTAGE TO IC'S

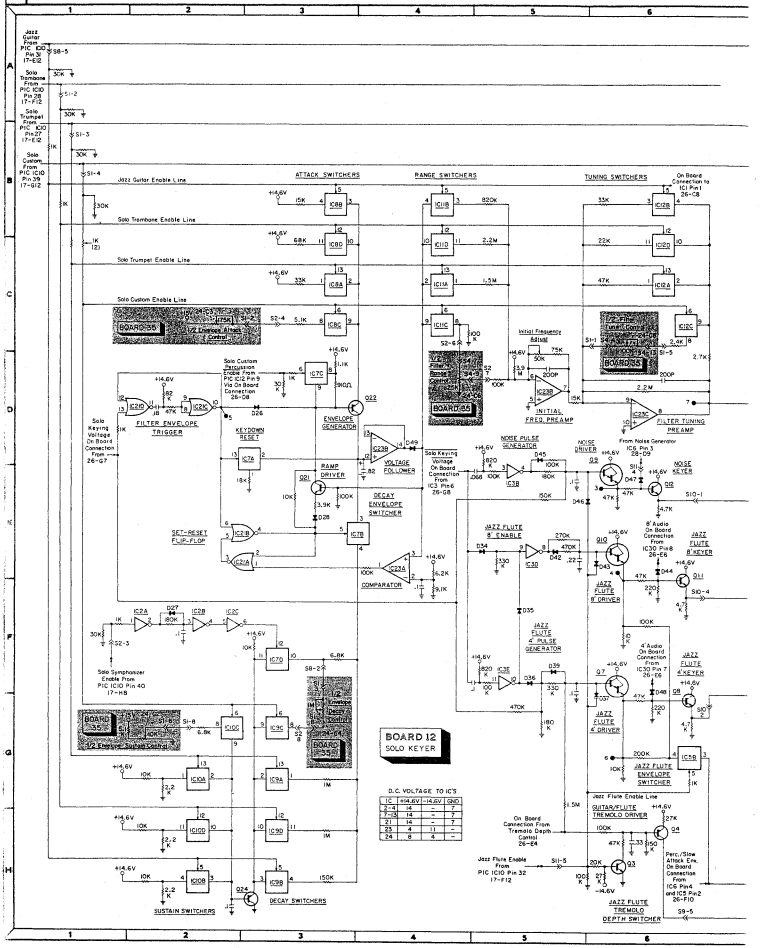
IC	+14.9V	+14.6V	-14.8V	GND
1-5	—	4	11	—
10	8	—	—	4
13	8	—	—	4
15	8	—	—	4

SOLO KEYER

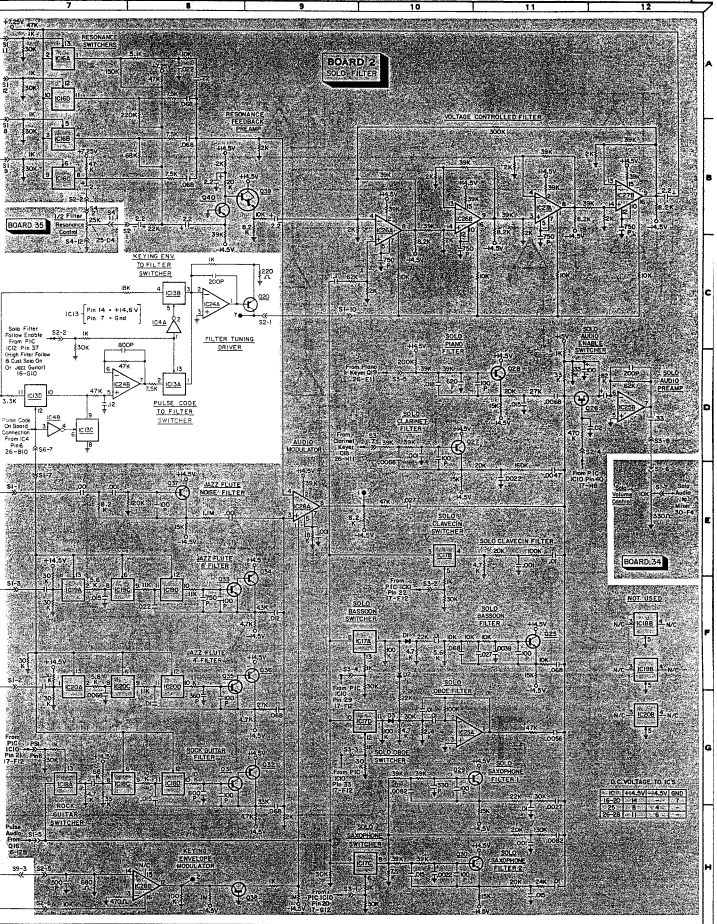

SOLO VIBRATO/ TREMOLO OSCILLATOR
DELAY TRIGGER
DELAY SWITCHER
IC2E
IC2D
IC2C
IC2B
BOARD 34
Tremolo Speed Control
Tremolo Depth Control
SOLO TUNING AND VIBRATO AMPLIFIER
VIBRATO DEPTH SWITCHER
VIBRATO/ GLIDE SWITCHER
IC22B
From PIC IC12 Pin 14 (High Jazz or Rock, Guitar on) I6-G10
From Solo Glide Driver Q34 23-D5
Vibrato Voltage From PIC IC12 Pin 40 (Low Piano or Clavecin On) I6-G10
Solo Keying Voltage (High with key pressed)
Solo Oscillator Tuning Coil
SOLO MASTER OSCILLATOR
SOLO NOTE GENERATOR
DIVIDER IC30
31.25 KHz
62.5 KHz
125 KHz
250 KHz
500 KHz
1 MHz
2 MHz
Osc. Freq.
Scan Clock From IC4 Pin 4 14-B12
Data Clock
BOARD 12
SOLO KEYER
BOARD 15
From IC4 Pin 6 I4-A12
IC29D
IC29C
IC29B
DATA SYNC STROBE
Strobe
Data
Time Pt. 96 Sync. Pulse From SIC IC25 Pin 8 I5-G8
IC2E
IC2F
IC2C
Upper Keyb Data from I3-A6
Upper Keyb Code Pulses From IC25 Pin 2 I4-D12
IC31B
SOLO DATA ENABLE
Solo Keying Enable From PIC IC10 Pin 38 (High Solo Keying On) I7-D12
New Keyups from IC25 Pin 10 I3-E9
New Keydown From IC25 Pin 15 I3-G4
NEW KEYDOWN RESET
4' Audio To QK 27-F6 On Board Connection
8' Audio To QK 27-F6 On Board Connection
NOT USED
IC4F
IC1E
IC1M
IC2F
N/C
+12V Zener
IC22A
SLOW ATTACK DRIVER MODULATOR
IC22D

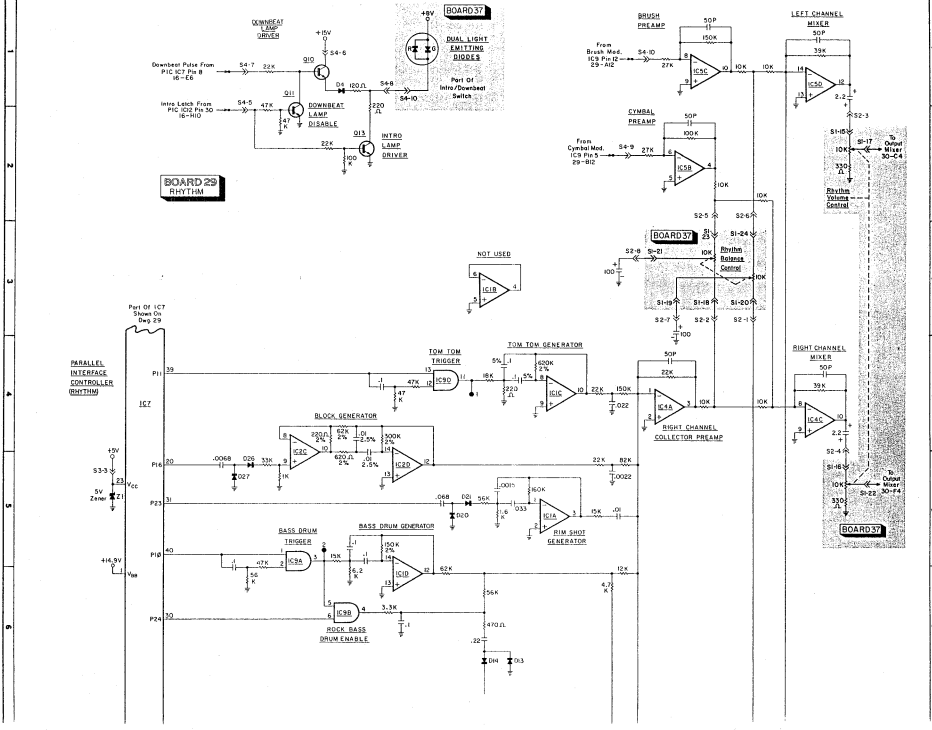

BOARD 12
SOLO KEYER
MINIMUM PULSE STRETCHER
16' Audio
Pulse Code
Clavecin Enable From PIC IC10 Pin 22 17-F12
CLAVECIN PULSE SNUB
SOLO CLAVECIN SNUB
Orchestral Symphonique Octave Select Enable To 24-E8
On Board Conn. From Jazz Guitar Enable 27-B6
JAZZ GUITAR SNUB
Percussion Envelope Enable From PIC IC10 Pin 8 High (Clavecin, Piano, Guitar or Custom Solo & Percuss. On) 16-F10
PERC. ENV. TO PULSE DRIVER SWITCHER
Solo Custom Percussion Enable From PIC IC12 Pin 9 (Low Custom Solo & Percuss. On) 16-F10
On Board Connection To IC7 Pin 6 27-D3
ROCK GUITAR SNUB
Rock Guitar Enable From PIC IC10 Pin 21 17-F12
PERCUSSION DRIVER
KEYER DELAY
PULSE INVERTER
INVERTER
SOLO PIANO SNUB
Piano Enable From PIC IC10 Pin 37 17-F12
SOLO SUSTAIN LENGTH SWITCHER
PERC. ENV. TO KEYING ENVELOPE MODULATOR SWITCHER
Solo Sustain Enable (High Piano or Clavecin On & Sustain Pedal Switch) From D31 23-E3
Solo Keying Voltage
Perc. Env. To Keying Env. Mod. Enable From PIC IC12 Pin 21 (High = Solo & Guitar, Solo & Percuss On) 16-G10
SLOW ATTACK DRIVER
SLOW ATTACK ENVELOPE TO KEYING ENV. SWITCHER
Slow Attack Enable From PIC IC12 Pin 9 (High = Oboe, Bassoon, Tromb., Trump. or Cust. Solo On) 16-F10
SLOW ATTACK ENABLE SWITCHER
Solo Keying Voltage On Board Connection To 27-D1
SOLO CLARINET DRIVER
Clarinet Enable From PIC IC10 Pin 30 17-G12
SOLO CLARINET KEYER
To Solo Clarinet Filter 027 27-D9
DISCHARGE REGULATION
PULSE DRIVER
PULSE WIDTH GENERATOR
Pulse Audio To Solo Filters 27-H7
Sax, Oboe, Bassoon Pulse Width Enable From PIC IC12 Pin 8 16-G10
Pulse Width Modulation Enable From PIC IC12 Pin 10 (High=Clavecin, Flute Guitar, Sax, Oboe, Bassoon, Trumb., Trump. or Cust. Solo On) 16-G10
PULSE WIDTH MODULATION ENABLE SWITCHER
PIANO KEYER
To Piano Filter 028 27-D10
On Board Connection To IC28 Pin 14 27-H6
D. C. VOLTAGE TO IC'S
IC | +16.6V | +14.9V | -16.6V | GND
1-5 | 16 | – | – | 7
22 | 4 | – | 11 | –
29 | 8 | – | – | 4
31 | – | 14 | – | 7

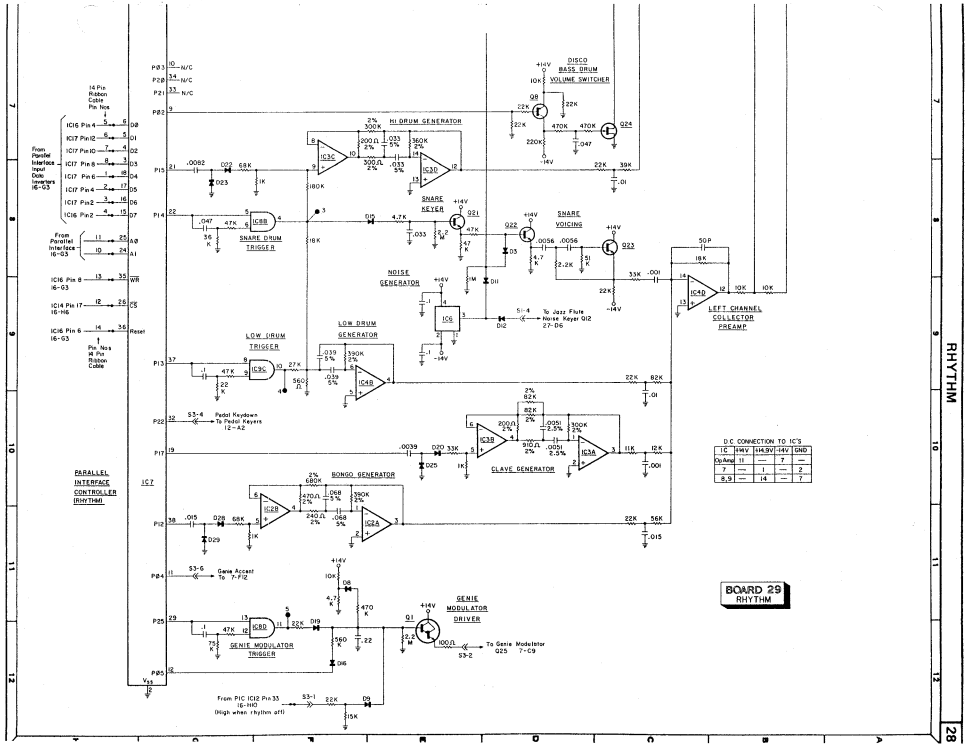
SOLO FILTER



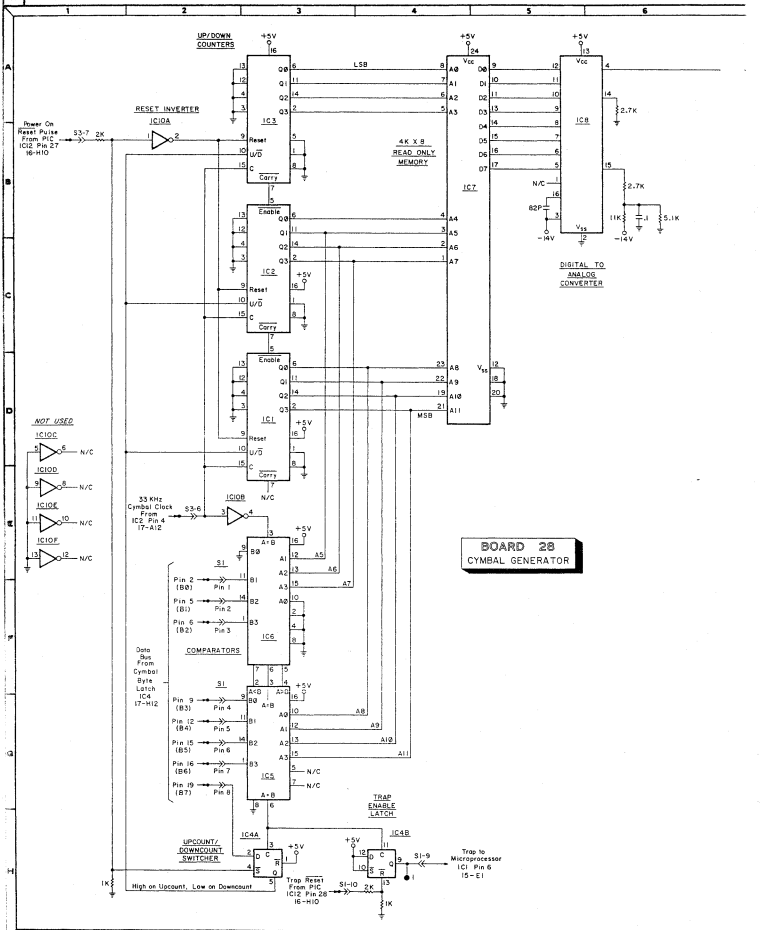
IC	+14.6V	-14.6V	GND
2-4	14	-	7
7-13	14	-	7
21	14	-	7
23	4	11	-
24	5	4	-

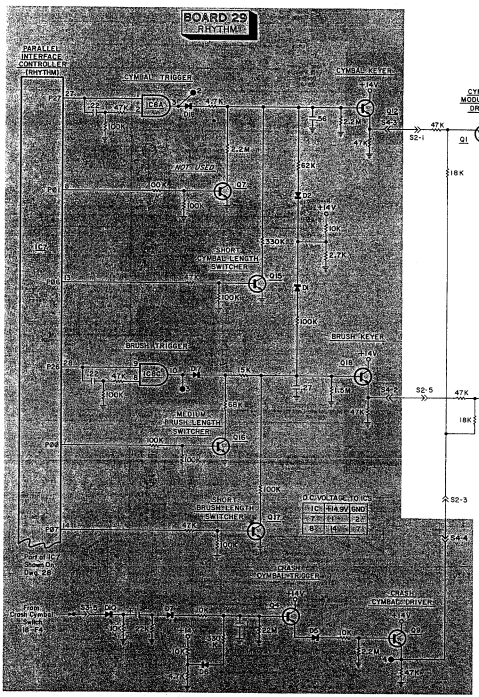

BOARD 2
SOLO FILTER
RESONANCE SWITCHES
RESONANCE FEEDBACK PREAMP
VOLTAGE CONTROLLED FILTER
BOARD 35
KEYING ENV. TO FILTER SWITCHER
FILTER TUNING DRIVER
PULSE CODE TO FILTER SWITCHER
SOLO FILTER Follow Enable From PIC IC12 Pin 37 Origin Filter Follow B Cut Solo On Or Jazz Guitar IS-G10
SOLO PIANO FILTER
SOLO AUDIO ENABLE SWITCHES
SOLO AUDIO PREAMP
SOLO CLAVICEN FILTER
AUDIO MOUSE KEY
BOARD 34
JAZZ FLUTE NOISE FILTER
JAZZ FLUTE E FILTER
SOLO CLAVICEN SWITCHER
SOLO CLAVICEN FILTER
SOLO BASSOON SWITCHER
SOLO BASSOON FILTER
NOT USED
JAZZ FLUTE F FILTER
SOLO OBOE FILTER
ROCK GUITAR FILTER
SOLO SAXOPHONE SWITCHER
SOLO SAXOPHONE FILTER
KEYING ENVELOPE MODULATOR
D.C. VOLTAGE TO IC'S

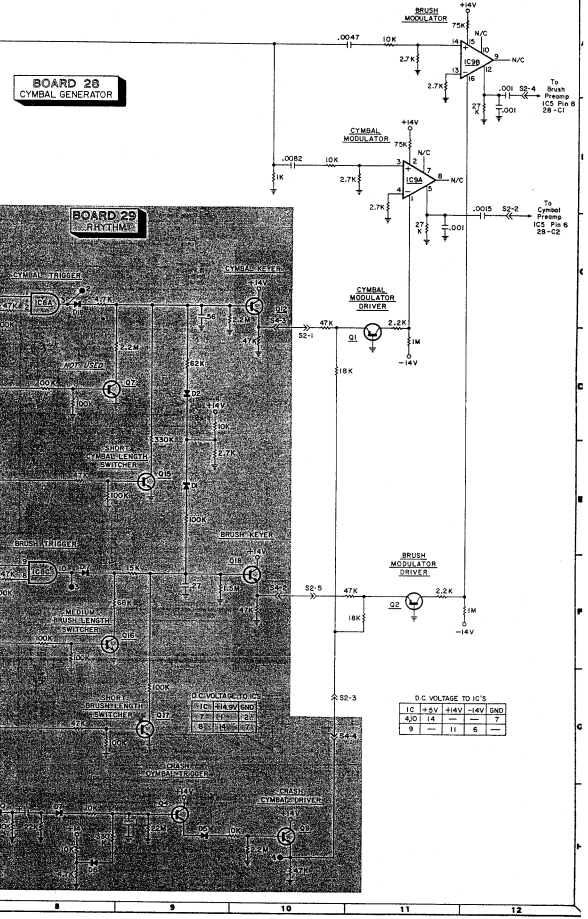

BOARD 29
RHYTHM
BOARD 37
DOWNBEAT LAMP DRIVER
DOWNBEAT LAMP DISABLE
INTRO LAMP DRIVER
DUAL LIGHT EMITTING DIODES
Part Of Intro/Downbeat Switch
Downbeat Pulse From PIC IC7 Pin 8 16-E8
Intro Latch From PIC IC12 Pin 50 16-H10
BRUSH PREAMP
From Brush Mod. IC9 Pin 12 29-A12
CYMBAL PREAMP
From Cymbal Mod. IC9 Pin 5 29-B12
LEFT CHANNEL MIXER
RIGHT CHANNEL MIXER
To Output Mixer 30-C4
Rhythm Volume Control
Rhythm Release Control
RIGHT CHANNEL COLLECTOR PREAMP
NOT USED
Part Of IC7 Shown On Dwg 29
PARALLEL INTERFACE CONTROLLER (RHYTHM)
TOM TOM TRIGGER
TOM TOM GENERATOR
BLOCK GENERATOR
BASS DRUM TRIGGER
BASS DRUM GENERATOR
ROCK BASS DRUM ENABLE
RIM SHOT GENERATOR
To Output Mixer 30-F4


RHYTHM
PARALLEL INTERFACE CONTROLLER (RHYTHM)
IC7
14 Pin Ribbon Cable Pin Nos.
From Parallel Interface Input Data Inverters 16-G3
IC16 Pin 4
IC17 Pin12
IC17 Pin10
IC17 Pin 8
IC17 Pin 6
IC17 Pin 4
IC17 Pin 2
IC16 Pin 2
D8
D1
D2
D3
D4
D5
D6
D7
From Parallel Interface 16-G3
A0
A1
IC16 Pin 8 16-G3
WR
IC14 Pin 17 16-H6
CS
IC16 Pin 6 16-G3
Reset
Pin Nos. 14 Pin Ribbon Cable
P03
P02
P21
P22
P15
P14
P13
P32
P17
P12
P04
P25
P05
Vss
10 N/C
34 N/C
33 N/C
9
21
22
37
32
19
38
11
29
12
S3-6 Genie Accent To 7-F12
S3-4 Pedal Keydown To Pedal Keyers 12-A2
From PIC IC12 Pin 33 16-H10 (High when rhythm off)
S3-1
HI DRUM GENERATOR
IC3C
IC3D
IC3E
IC3F
SNARE KEYER
Q21
SNARE DRUM TRIGGER
IC8B
SNARE VOICING
Q22
Q23
NOISE GENERATOR
D11
IC6
D12
S1-4 To Jazz Flute Horse Keyer Q12 27-D6
LOW DRUM TRIGGER
IC9C
LOW DRUM GENERATOR
IC4B
BONGO GENERATOR
IC2B
IC2A
CLAVE GENERATOR
IC3B
IC3A
GENIE MODULATOR TRIGGER
IC8D
GENIE MODULATOR DRIVER
Q1
To Genie Modulator Q25 7-C9
DISCO BASS DRUM VOLUME SWITCHER
Q24
Q20
Q18
D13
D14
D15
D16
D17
D18
D19
D20
D21
D22
D23
D24
D25
D26
D27
D28
D29
IC40
LEFT CHANNEL COLLECTOR PREAMP
+14V
-14V
DC CONNECTION TO IC'S
IC | +14V | 11+14.5V | -14V | GND
Op Amp | 11 | — | 7 | —
7 | — | 1 | — | 2
8,9 | — | 14 | — | 7
BOARD 29 RHYTHM
71
28

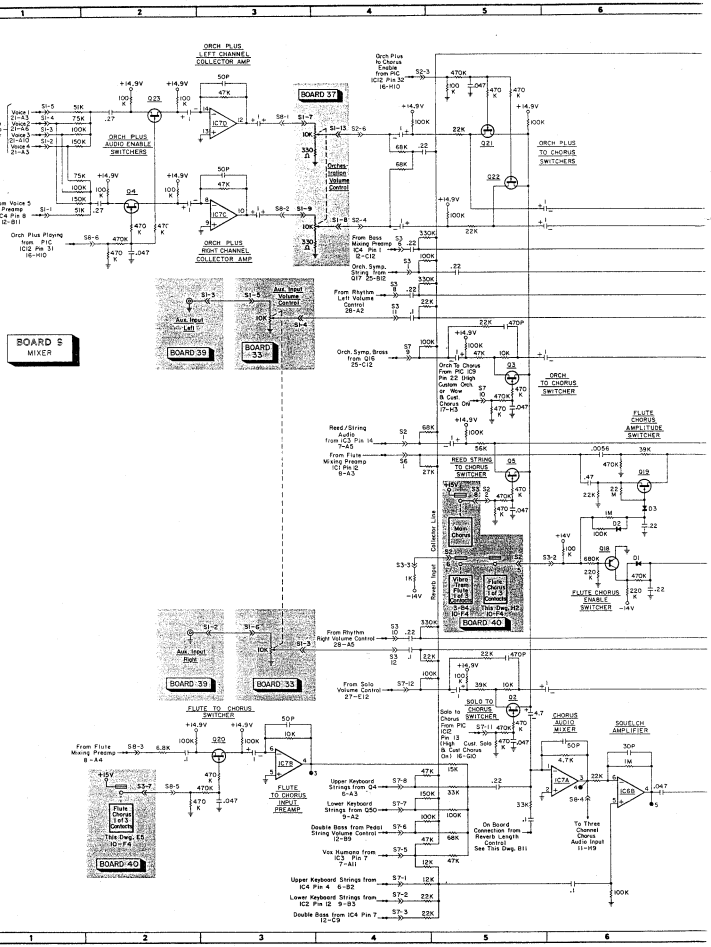
BRUSH CYMBAL GENERATOR



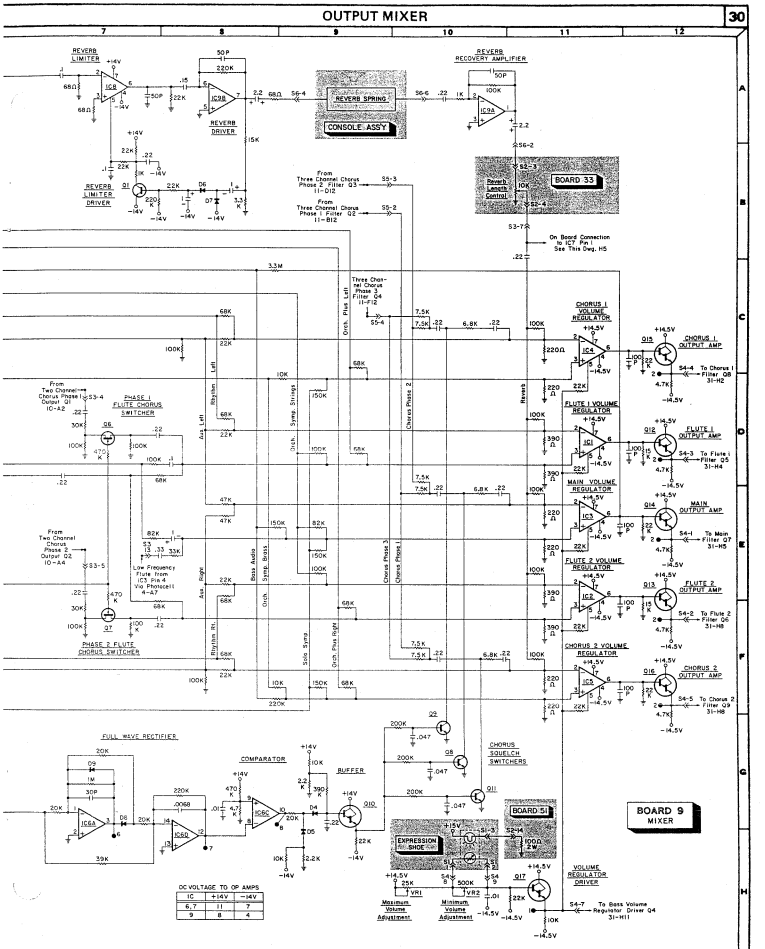

BOARD 29
RHYTHMS
PARALLEL INTERFACE CONTROLLER (RHYTHM)
CYMBAL TRIGGER
CYMBAL KEYER
BRUSH TRIGGER
BRUSH KEYER
SHORT CYMBAL LENGTH SWITCHER
MEDIUM BRUSH LENGTH SWITCHER
SHORT BRUSH LENGTH SWITCHER
CRASH CYMBAL TRIGGER
CRASH CYMBAL DRIVER
DC VOLTAGE TO IC'S
IC +5V +14V -14V GND
4,10 14 — — 7
9 — 11 6 —

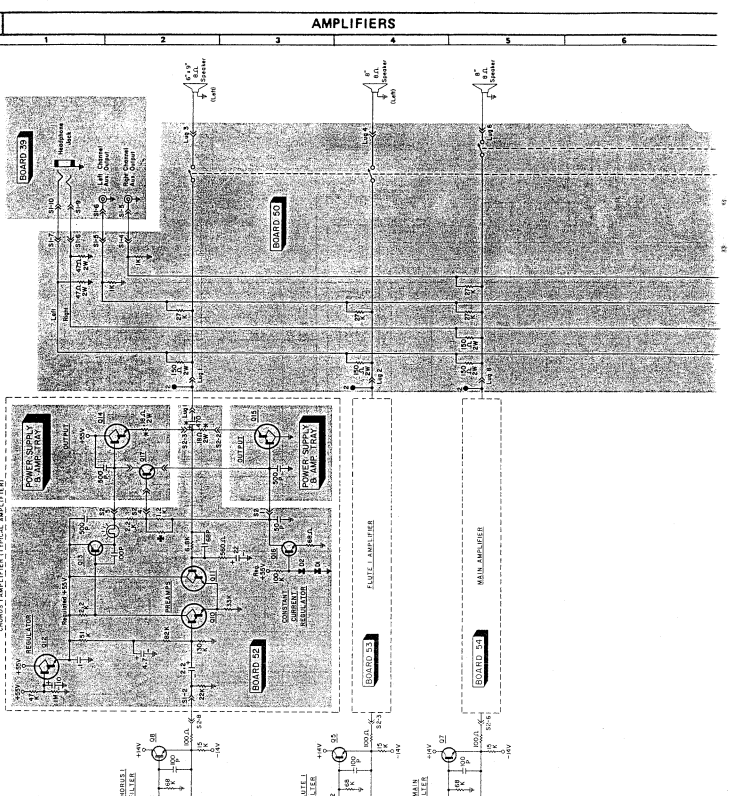

BOARD 28
CYMBAL GENERATOR
BRUSH MODULATOR
CYMBAL MODULATOR
CYMBAL MODULATOR DRIVER
BRUSH MODULATOR DRIVER
To Brush Preamp IC5 Pin 8 28-C1
To Cymbal Preamp IC5 Pin 6 28-C2
DC VOLTAGE TO IC'S
IC +5V +14V -14V GND
4,10 14 — — 7
9 — 11 6 —

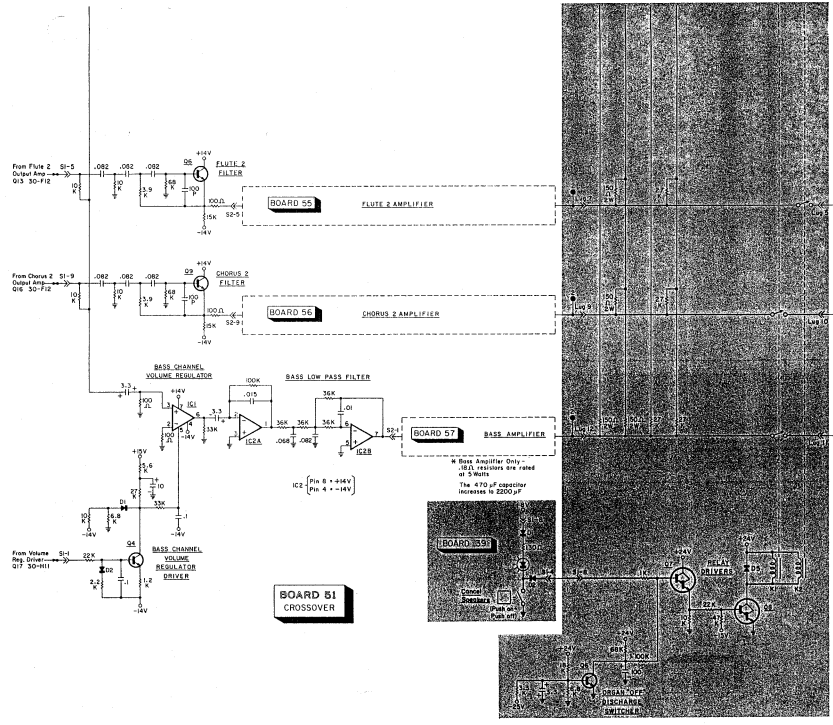
OUTPUT MIXER


BOARD S
MIXER
BOARD 39
BOARD 33
BOARD 37
BOARD 40
ORCH PLUS
LEFT CHANNEL
COLLECTOR AMP
ORCH PLUS
RIGHT CHANNEL
COLLECTOR AMP
ORCH PLUS
AUDIO ENABLE
SWITCHERS
ORCH PLUS
TO CHORUS
SWITCHERS
Orchestration Volume Control
Aux. Input Volume Control
Aux. Input
Aux. Input Left
Aux. Input Right
From Orch Plus Audio Modulator
From Voice 5 Preamp IC4 Pin 8 12-B11
Orch Plus Playing from PIC IC12 Pin 51 16-H10
From Orch Plus Mixing Preamp IC4 Pin 1 12-C12
From Bass Mixing Preamp IC4 Pin 7 12-C12
Orch. Symp. Strings from QI7 25-B12
From Rhythm L.H. Volume Control 28-A2
Orch. Symp. Brass from QI6 25-C12
Orch To Chorus From PIC IC9 Pin 22 (High Custom Orch. or Wow & Cust. Chorus On) 17-H3
ORCH TO CHORUS SWITCHER
Reed/String Audio from IC3 Pin 14 7-A5
From Flute Mixing Preamp IC1 Pin 2 8-A3
REED STRING TO CHORUS SWITCHER
FLUTE CHORUS AMPLITUDE SWITCHER
FLUTE CHORUS ENABLE SWITCHER
Collector Line
Reeds Input
From Rhythm Right Volume Control 28-A5
From Solo Volume Control 27-E12
SOLO TO CHORUS SWITCHER
Solo to Chorus From PIC IC11 Pin 13 (High Cust. Solo & Cust. Chorus On) 16-G10
CHORUS AUDIO MIXER
SQUELCH AMPLIFIER
To Three Speed Chorus Audio Input 11-H9
FLUTE TO CHORUS SWITCHER
From Flute Mixing Preamp 8-A4
FLUTE TO CHORUS INPUT PREAMP
Flute Chorus 1 of 3 Contacts This Dwg. E6 10-F4
Upper Keyboard Strings from Q4 5-A3
Lower Keyboard Strings from Q50 9-A2
Double Bass from Pedal String Volume Control 12-B9
Vox Humana from IC3 Pin 7 7-A11
Upper Keyboard Strings from IC4 Pin 4 6-B2
Lower Keyboard Strings from IC2 Pin 12 9-B3
Double Bass from IC4 Pin 7 12-C9
On Board Controls (Reverb Length Control) See This Dwg. B11

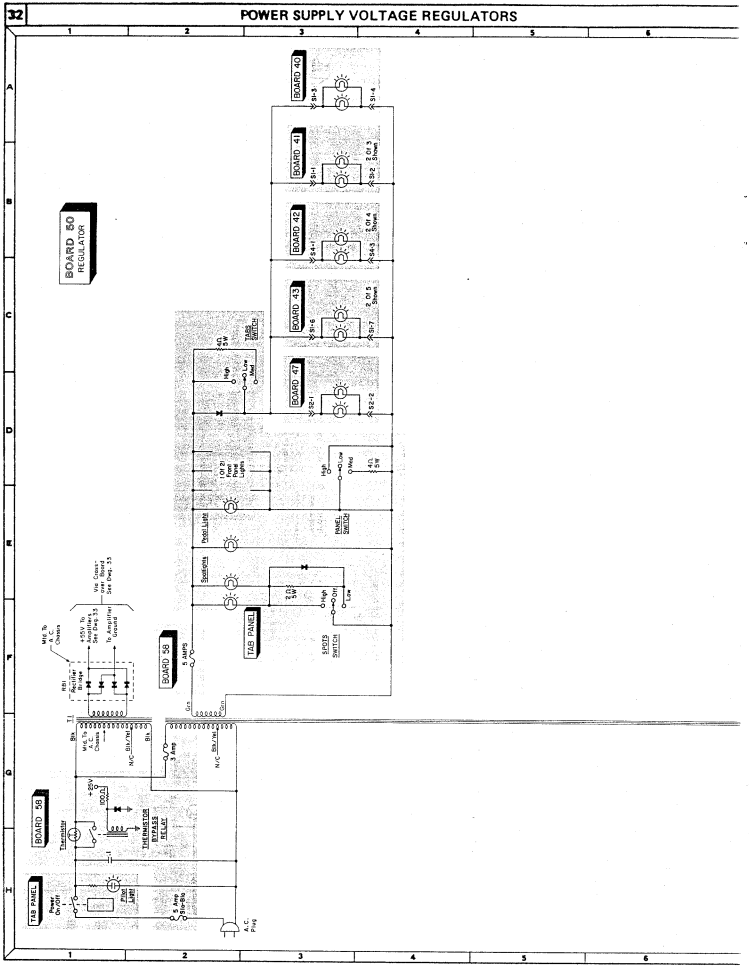
OUTPUT MIXER

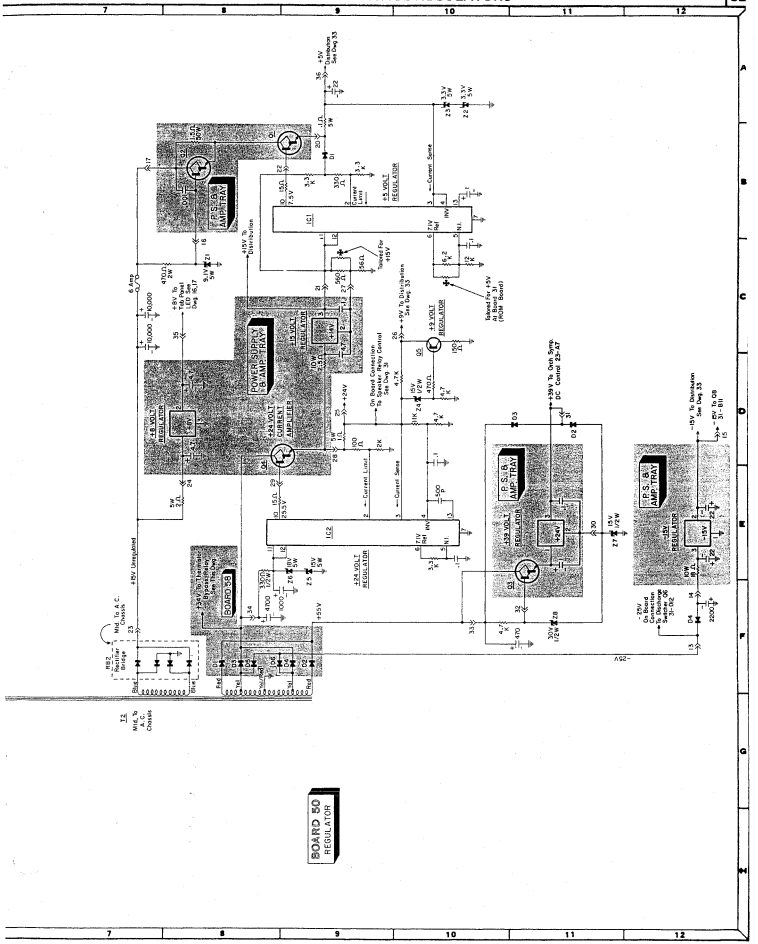

REVERB LIMITER
REVERB DRIVER
REVERB LIMITER DRIVER
REVERB RECOVERY AMPLIFIER
REVERB SPRING
CONSOLE ASSY
BOARD 33
Reverb Length Control
From Three Channel Chorus Phase 3 Filter Q3 11-D12
From Three Channel Chorus Phase 2 Filter Q2 11-B12
On Board Connection to IC1 See This Dwg. H5
Three Channel Chorus Phase 3 Filter Q4 11-F12
CHORUS 1 VOLUME REGULATOR
CHORUS 1 OUTPUT AMP
To Chorus 1 Filter Q8 31-H2
From Two Channel Chorus Phase 1 Output Q1 10-A2
PHASE 1 FLUTE CHORUS SWITCHER
FLUTE 1 VOLUME REGULATOR
FLUTE 1 OUTPUT AMP
To Flute 1 Filter Q5 31-H4
MAIN VOLUME REGULATOR
MAIN OUTPUT AMP
To Main Filter Q7 31-H5
From Two Channel Chorus Phase 2 Output Q2 10-A4
Low Frequency Flute from IC3 Pin 4 Via Photocell 4-A3
PHASE 2 FLUTE CHORUS SWITCHER
FLUTE 2 VOLUME REGULATOR
FLUTE 2 OUTPUT AMP
To Flute 2 Filter Q6 31-H8
CHORUS 2 VOLUME REGULATOR
CHORUS 2 OUTPUT AMP
To Chorus 2 Filter Q9 31-H6
FULL WAVE RECTIFIER
COMPARATOR
BUFFER
CHORUS SQUELCH SWITCHERS
EXPRESSION PEDAL SHOE
BOARD 51
VOLUME REGULATOR DRIVER
To Bass Volume Regulator Driver Q4 31-H11
Minimum Volume Adjustment
Minimum Volume Adjustment
BOARD 9 MIXER
DC VOLTAGE TO OP AMPS
IC | +14V | -14V
6,7 | 11 | 7
9 | 8 | 4


CHORUS AMPLIFIER (TYPICAL AMPLIFIER)
BOARD 51 CROSSOVER
BOARD 52
BOARD 53
BOARD 54
BOARD 55
BOARD 56
CHORUS FILTER
FLUTE I FILTER
MAIN FILTER
FLUTE I AMPLIFIER
MAIN AMPLIFIER
POWER SUPPLY & AMPLIFIER
PREAMPS
CONSTANT CURRENT REGULATOR
Headphone Jack
Left Chorus Level
Right Chorus Level
Left Chorus Output
Right Chorus Output
8" 8Ω Speaker
4"x6" 8Ω Speaker

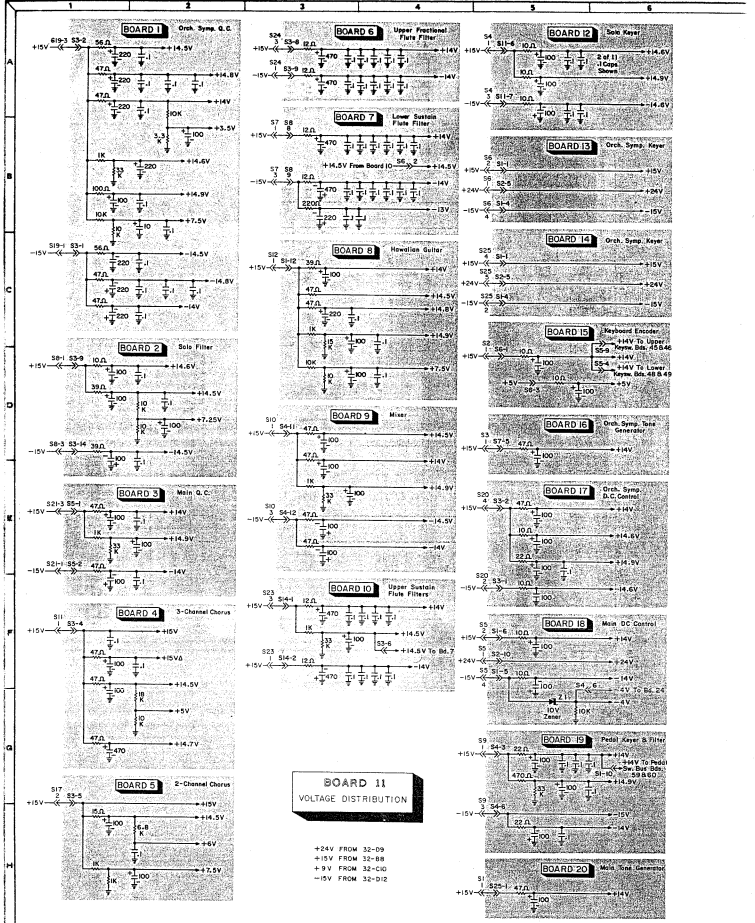

From Flute 2 Output Amp Q13 30-F12
SI-5
FLUTE 2 FILTER
BOARD 55
FLUTE 2 AMPLIFIER
From Chorus 2 Output Amp Q16 30-F12
SI-9
CHORUS 2 FILTER
BOARD 56
CHORUS 2 AMPLIFIER
BASS CHANNEL VOLUME REGULATOR
BASS LOW PASS FILTER
BOARD 57
BASS AMPLIFIER
* Bass Amplifier Only - 18Ω resistors are rated at 5 Watts
The 470 µF capacitor increases to 2200 µF
From Volume Reg. Drive Q17 30-H11
SI-1
BASS CHANNEL VOLUME REGULATOR DRIVER
BOARD 51
CROSSOVER
BOARD 59B
Cancel Sostenuto
Push on
Push off
REV. +14V DRIVERS
8" 8Ω Speaker (Right)
6"x9" 8Ω Speaker (Right)
10" 8Ω Bass Speaker
10" 8Ω Bass Speaker
ORGAN TURN-ON DISCHARGE SWITCHES

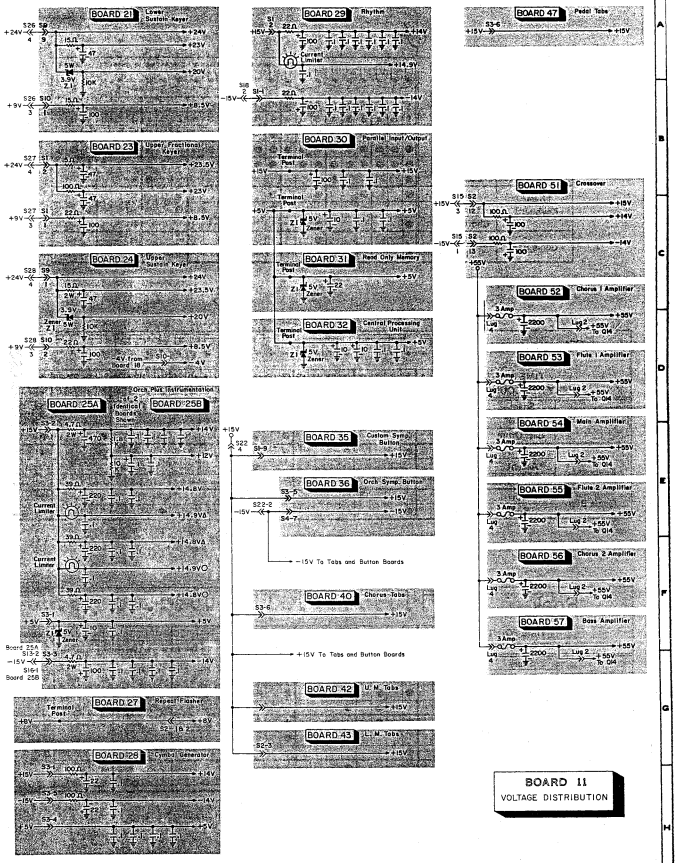
POWER SUPPLY VOLTAGE REGULATORS




BOARD 50
REGULATOR
POWER SUPPLY
(S) AMPLIFIER
BOARD 55
+45V Unregulated
+34V To Thermistor Bias Network On Board 55
+34V Unregulated
+45V To Distribution
+8V To Tape Out Sw. Deg. 16-17
+8V To Tape Out Sw. Deg. 16-17
+15V To Distribution See Deg. 33
+15V To Distribution See Deg. 33
+15V To Distribution See Deg. 33
+45V To Distribution See Deg. 33
+45V To Distribution See Deg. 33
+45

POWER SUPPLY VOLTAGE DISTRIBUTION


BOARD 1 Orch. Symp. Q.C.
BOARD 2 Solo Filter
BOARD 3 Main Q.C.
BOARD 4 3-Channel Chorus
BOARD 5 2-Channel Chorus
BOARD 6 Upper Fractional Flute Filter
BOARD 7 Lower Sustain Flute Filter
BOARD 8 Hawaiian Guitar
BOARD 9 Mixer
BOARD 10 Upper Sustain Flute Filters
BOARD 11 VOLTAGE DISTRIBUTION
+24V FROM 32-D9
+15V FROM 32-B8
+9V FROM 32-C10
-15V FROM 32-D12
BOARD 12 Solo Keyer
BOARD 13 Orch. Symp. Keyer
BOARD 14 Orch. Symp. Keyer
BOARD 15 Keyboard Extender
BOARD 16 Orch. Symp. Tone Generator
BOARD 17 Orch. Symp. D.C. Control
BOARD 18 Main DC Control
BOARD 19 Pedal Keyer & Filter
BOARD 20 Main Tone Generator


BOARD 21 Lower Custom Keyer
BOARD 23 Upper Fractional Keyer
BOARD 24 Upper Custom Keyer
BOARD 29 Rhythm
BOARD 30 Parallel Input/Output
BOARD 31 Read Only Memory
BOARD 32 Central Processing Unit
BOARD 47 Pedal Tone
BOARD 51 Crossover
BOARD 52 Chorus 1 Amplifier
BOARD 53 Flute 1 Amplifier
BOARD 54 Main Amplifier
BOARD 55 Flute 2 Amplifier
BOARD 56 Chorus 2 Amplifier
BOARD 57 Bass Amplifier
BOARD 25A Clock, Mute, Test/Combination Transition Boards Shown
BOARD 25B
BOARD 35 Custom Sync Button
BOARD 36 Orch. Sync Button
BOARD 40 Chorus Tabs
BOARD 42 U.M. Tabs
BOARD 43 L.M. Tabs
BOARD 27 Repeat Flasher
BOARD 28 Cymbal Generator
−15V To Tabs and Button Boards
+15V To Tabs and Button Boards
BOARD 11
VOLTAGE DISTRIBUTION

Ballad

		TIME POINT	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
		RHYTHM COUNT	1	&a	2	&a	3	&a	4	&a					1	&a	2	&a	3	&a	4	&a				
Instrumentation	Snare						●					●							●					●		
	Brush		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
	Brush Snub		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
	Bass Drum		●					●	●						●						●	●				
Lower Keyboard	Chord		●				●				●				●				●				●			
	*Accent						●				●								●				●			
	Chord Sustain		●						●						●						●					
Genie Bass	5th								●												●					
	Root		●					●							●					●						

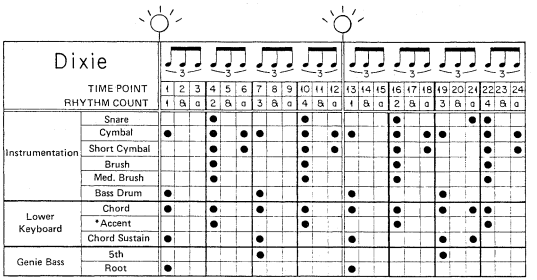
Tango

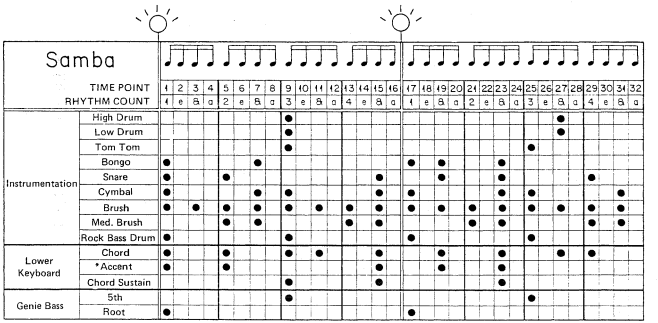
		TIME POINT	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
		RHYTHM COUNT	1	e	&	a	2	e	&	a	3	e	&	a	4	e	&	a	1	e	&	a	2	e	&	a	3	e	&	a	4	e	&	a
Instrumentation	Snare		●				●				●				●		●	●	●				●				●				●		●	●
	Cymbal																																	●
	Bass Drum		●				●				●				●		●		●				●				●				●		●	
Lower Keyboard	Chord		●				●				●				●		●				●				●				●		●	
	*Accent																●																●	
	Chord Sustain																●																	●
Genie Bass	5th										●				●												●				●			
	Root		●				●												●				●											

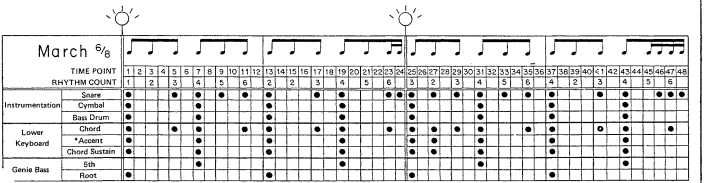
Rock

		TIME POINT	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
		RHYTHM COUNT	1	e	&	a	2	e	&	a	3	e	&	a	4	e	&	a	1	e	&	a	2	e	&	a	3	e	&	a	4	e	&	a
Instrumentation	Snare						●								●								●								●			
	Cymbal		●		●		●		●		●		●						●		●		●		●		●		●		●		●	
	Short Cymbal		●		●		●		●		●				●		●		●		●		●		●		●				●		●	
	Bass Drum		●						●		●								●						●		●							
Lower Keyboard	Chord						●		●						●								●		●						●			
	*Accent														●																●			
	Chord Sustain						●								●								●								●			
Genie Bass	5th										●																●							
	Root		●						●										●						●									

*Accent refers to Lower Keyboard Accent Circuit located on Drawing 7-E11.





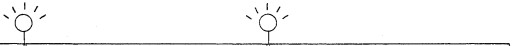


*Accent refers to Lower Keyboard Accent Circuit located on Drawing 7-E11.

Swing

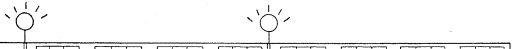
		TIME POINT	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
		RHYTHM COUNT	1	&	a	2	&	a	3	&	a	4	&	a	1	&	a	2	&	a	3	&	a	4	&	a
Instrumentation	High Drum											●												●		
	Rim Shot											●												●		
	Cymbal		●			●			●	●		●		●	●			●			●		●	●		●		●
	Short Cymbal					●		●				●		●				●			●			●				
	Bass Drum		●			●			●			●			●			●			●			●				
Lower Keyboard	Chord		●					●				●									●					●		
	*Accent		●									●									●							
	Chord Sustain																				●							
Genie Bass	5th								●			●											●			●		
	Root		●			●									●						●							

Bosa Nova



		TIME POINT	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
		RHYTHM COUNT	1	e	&	a	2	e	&	a	3	e	&	a	4	e	&	a	1	e	&	a	2	e	&	a	3	e	&	a	4	e	&	a
Instrumentation	Block		●						●						●								●						●					
	High Drum		●						●						●								●						●					
	Cymbal								●					●											●								●	
	Short Cymbal								●					●											●								●	
	Brush		●		●		●		●		●		●		●		●		●		●		●		●		●		●		●		●	
	Med. Brush						●		●						●		●						●		●						●		●	
	Bass Drum		●						●		●								●						●		●							
Lower Keyboard	Chord		●				●				●		●				●				●				●				●		●			
	*Accent		●				●				●						●								●				●					
	Chord Sustain		●								●										●													
Genie Bass	5th										●																●							
	Root		●						●																●									

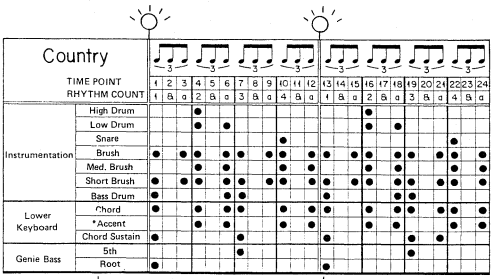
Soft Rock

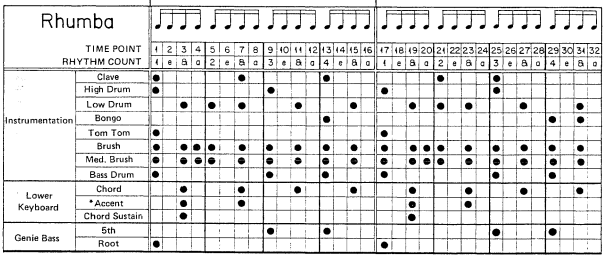


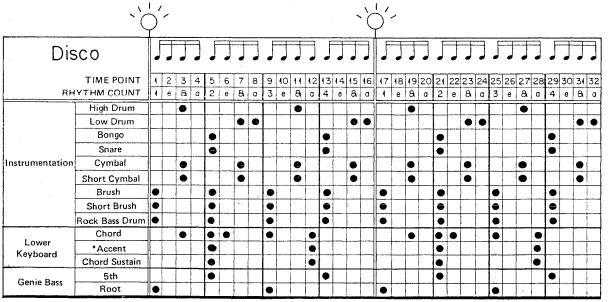
		TIME POINT	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
		RHYTHM COUNT	1	e	&	a	2	e	&	a	3	e	&	a	4	e	&	a	1	e	&	a	2	e	&	a	3	e	&	a	4	e	&	a
Instrumentation	Snare										●																●							
	Cymbal																																●	
	Brush		●		●		●		●		●		●		●		●		●		●		●		●		●		●		●		●	
	Med. Brush		●		●		●		●		●		●		●		●				●		●		●		●		●		●		●	
	Rock Bass Drum		●				●								●						●				●									
Lower Keyboard	Chord		●				●				●				●						●				●		●				●			
	*Accent										●																●				●			
	Chord Sustain		●				●				●				●												●							
Genie Bass	5th										●																●							
	Root		●				●								●						●				●									

*Accent refers to Lower Keyboard Accent Circuit located on Drawing 7-E11.

RHYTHM PATTERN CHARTS

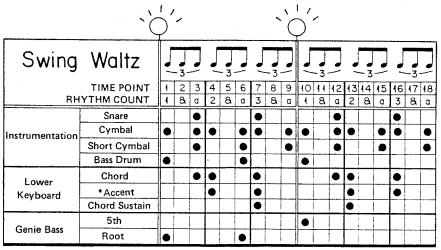



Rhumba
TIME POINT
RHYTHM COUNT
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32
t e & a 2 e & a 3 e & a 4 e & a t e & a 2 e & a 3 e & a 4 e & a
Clave
Instrumentation
High Drum
Low Drum
Bongo
Tom Tom
Brush
Med. Brush
Bass Drum
Lower Keyboard
Chord
*Accent
Chord Sustain
Genie Bass
5th
Root

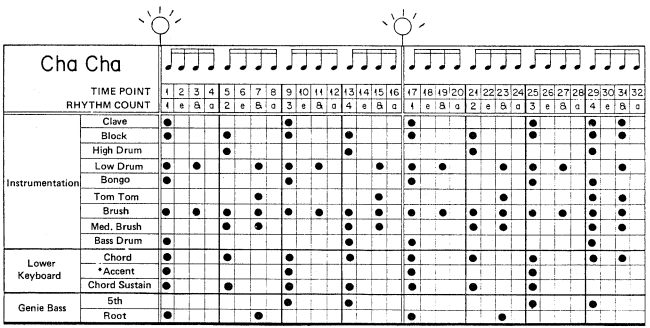

Disco
TIME POINT
RHYTHM COUNT
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32
t e & a 2 e & a 3 e & a 4 e & a t e & a 2 e & a 3 e & a 4 e & a
Instrumentation
High Drum
Low Drum
Bongo
Snare
Cymbal
Short Cymbal
Brush
Short Brush
Rock Bass Drum
Lower Keyboard
Chord
*Accent
Chord Sustain
Genie Bass
5th
Root

*Accent refers to Lower Keyboard Accent Circuit located on Drawing 7-E11.

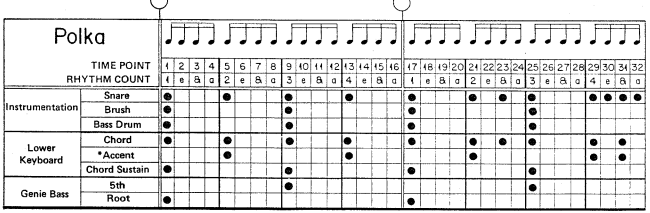
Swing Waltz



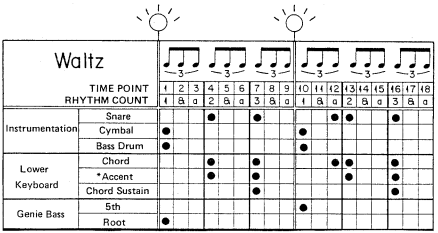
Cha Cha

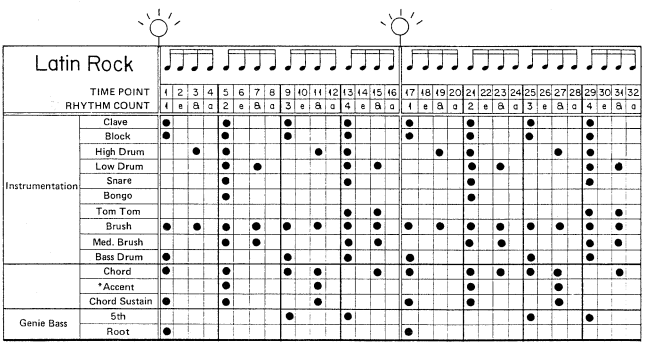

TIME POINT
RHYTHM COUNT
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32
1 e & a 2 e & a 3 e & a 4 e & a 1 e & a 2 e & a 3 e & a 4 e & a
Instrumentation
Clave
Block
High Drum
Low Drum
Bongo
Tom Tom
Brush
Med. Brush
Bass Drum
Lower Keyboard
Chord
*Accent
Chord Sustain
Genie Bass
5th
Root

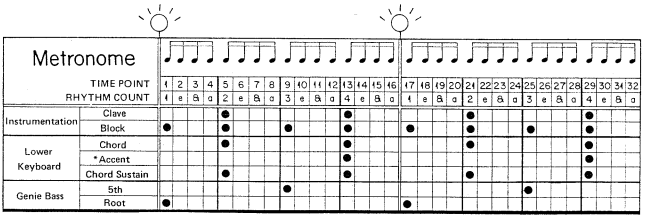
Polka


TIME POINT
RHYTHM COUNT
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32
1 e & a 2 e & a 3 e & a 4 e & a 1 e & a 2 e & a 3 e & a 4 e & a
Instrumentation
Snare
Brush
Bass Drum
Lower Keyboard
Chord
*Accent
Chord Sustain
Genie Bass
5th
Root

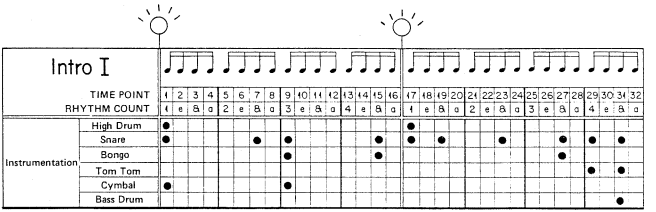
*Accent refers to Lower Keyboard Accent Circuit located on Drawing 7-E11.


Waltz
TIME POINT 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
RHYTHM COUNT 1 & a 2 & a 3 & a 1 & a 2 & a 3 & a
Instrumentation
Snare
Cymbal
Bass Drum
Lower Keyboard
Chord
*Accent
Chord Sustain
Genie Bass
5th
Root

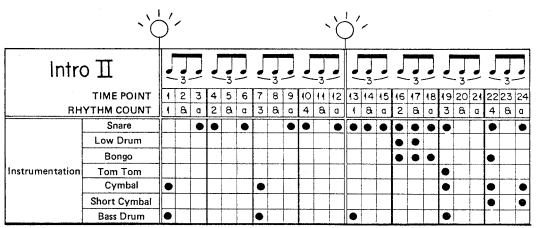

Latin Rock
TIME POINT 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32
RHYTHM COUNT 1 e & a 2 e & a 3 e & a 4 e & a 1 e & a 2 e & a 3 e & a 4 e & a
Instrumentation
Clave
Block
High Drum
Low Drum
Snare
Bongo
Tom Tom
Brush
Med. Brush
Bass Drum
Chord
*Accent
Chord Sustain
Genie Bass
5th
Root


Metronome
TIME POINT 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32
RHYTHM COUNT 1 e & a 2 e & a 3 e & a 4 e & a 1 e & a 2 e & a 3 e & a 4 e & a
Instrumentation
Clave
Block
Lower Keyboard
Chord
*Accent
Chord Sustain
Genie Bass
5th
Root

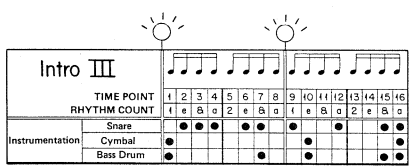
*Accent refers to Lower Keyboard Accent Circuit located on Drawing 7-E11.



Used for Ballad, Dixie, Swing, Country & March Rhythms.



Used for Swing Waltz & Waltz Rhythms.



Used for Tango, Samba, Bosa Nova, Rhumba, Cha Cha, Latin Rock, Rock, Soft Rock, Disco, Polka & Metronome Rhythms.

*Accent refers to Lower Keyboard Accent Circuit located on Drawing 7-E11.

ORCH. PLUS STYLE	VOICE CHANNEL	MODE		
		NORMAL	VARIATION	BASIC
BIG BAND	1	Brass/Sax	Brass Pattern	Brass plays brass and sax patterns
	2	Brass/Sax	Brass Pattern	Brass plays brass and sax patterns
	3	Brass/Sax	Brass Pattern	Brass plays brass and sax patterns
	4	Brass/Sax	Brass Pattern	Brass plays brass and sax patterns
	5	Brass/Sax	Brass Pattern	Brass plays brass and sax patterns
	6	String Bass	No Change	No Change
CONTEMPO	1	Electric Guitar	Electric Guitar with Chorus	No Change
	2	Electric Guitar	Electric Guitar with Chorus	No Change
	3	Electric Guitar	Electric Guitar with Chorus	No Change
	4	Cello	No Change	No Change
	5	None	Electric Bass *	None
	6	Electric Bass	None	No Change
POLKA**	1	Clarinet/ Trumpet	No Change	Trumpet
	2	Clarinet/ Trumpet	No Change	Trumpet
	3	Brass	No Change	No Change
	4	Brass	No Change	No Change
	5	Brass	No Change	No Change
	6	Tuba	No Change	No Change
COUNTRY	1	Piano/ Steel Guitar	None	No Change
	2	Piano/ Steel Guitar	None	No Change
	3	Acoustic Guitar	No Change	No Change
	4	Acoustic Guitar	No Change	No Change
	5	Acoustic Guitar	No Change	No Change
	6	String Bass	No Change	No Change
JAZZ GUITAR	1	Electric Guitar	No Change	Pattern Changes
	2	Electric Guitar	No Change	None
	3	Electric Guitar	No Change	No Change
	4	Electric Guitar	No Change	No Change
	5	None	String Bass*	None
	6	String Bass	None	No Change
ROCK	1	Electric Guitar	Synthesized Electric Guitar	No Change
	2	Electric Guitar	Synthesized Electric Guitar	No Change
	3	Electric Guitar	Synthesized Electric Guitar	No Change
	4	Electric Guitar	Synthesized Electric Guitar	No Change
	5	None	None	None
	6	Electric Bass	No Change	No Change

ORCH. PLUS STYLE	VOICE CHANNEL	MODE		
		NORMAL	VARIATION	BASIC
BAROQUE	1	Harpsichord	No Change	No Change
	2	Harpsichord	No Change	No Change
	3	Harpsichord	No Change	No Change
	4	Harpsichord	No Change	No Change
	5	Harpsichord	No Change	No Change
	6	Electric Bass	None	No Change
BLUE GRASS	1	Banjo	Banjo/Fiddle	No Change
	2	None	Fiddle	None
	3	None	Fiddle	None
	4	Acoustic Guitar	No Change	No Change
	5	Acoustic Guitar	No Change	No Change
	6	String Bass/ Acoustic Guitar	No Change	No Change
RHYTHM GUITAR	1	Acoustic Guitar	No Change	Pattern Changes
	2	Acoustic Guitar	No Change	Pattern Changes
	3	Acoustic Guitar	No Change	No Change
	4	Acoustic Guitar	No Change	Pattern Change
	5	None	String Bass*	None
	6	String Bass	None	No Change
DISCO	1	None	Brass	None
	2	None	Brass	None
	3	None	Brass	None
	4	Clavinet	Brass/Clavinet	No Change
	5	Clavinet	Brass/Clavinet	No Change
	6	Electric Bass	No Change	No Change
WALTZ	1	Strings	Acoustic Guitar	No Change
	2	Strings	Acoustic Guitar	No Change
	3	Strings	Acoustic Guitar	No Change
	4	Bowed String	Acoustic Guitar	No Change
	5	Hi/Lo Strings	String Bass*	No Change
	6	String Bass	None	No Change
LATIN	1	Electric Guitar	Acoustic Guitar	None
	2	Electric Guitar	Acoustic Guitar	No Change
	3	Electric Guitar	Acoustic Guitar	No Change
	4	Electric Guitar	Acoustic Guitar	No Change
	5	None	None	None
	6	String Bass	No Change	No Change

*When turning on Variation with the Contempo, Jazz Guitar, Rhythm Guitar or Waltz styles, the Bass Pattern changes and the Bass Asatto is produced by Voice Channel 5 instead of Channel 6.

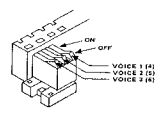
**The Musette Accordion Voice plays in Voice Channels 1 & 2 if the C chord is mirrored. Turning on variation silences this voice.

NONE = Channel not used at this time.

NORMAL MODE = Orch. Plus preset on without Variation or Basic Mode.

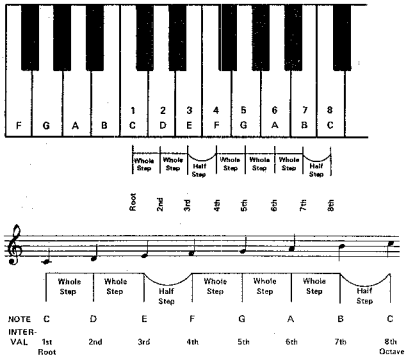
NO CHANGE = No change from Normal Mode of operation.

NOTE: To check Orch. Plus styles, press "C" key on Lower Keyboard. Shut off three position DIP Switches located on Boards 25A and 25B. Turn on each voice channel one at a time. See Chart below.

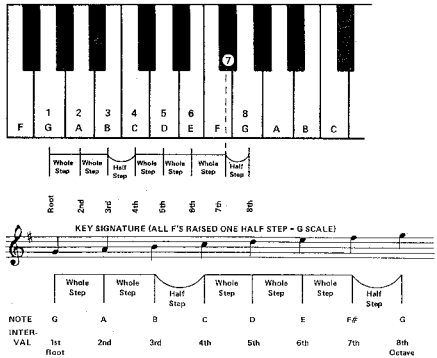


STYLE	NORMAL	VARIATION	MINOR (BASIC) MODE
BIG BAND NORMALLY 4/4 CAN PLAY 3/4	- BRASS SECTION - SAX SECTION - 4 BEAT STRING BASS - BRASS SECTION FIGURES ALTERNATE WITH SAX SECTION FIGURES	- BRASS FIGURES ONLY	- BRASS SECTION PLAYS BRASS FIGURES ALTERNATING WITH BRASS SECTION PLAYING SAX FIGURES
CONTEMPORARY NORMALLY 4/4 CAN PLAY 3/4	- ARPEGGIATED ELECTRIC GUITAR - CELLO - ELECTRIC BASS	- "PHASING" SOUND IS ADDED TO ELECTRIC GUITAR - BASS FIGURES BECOME MORE ACTIVE	- NO EFFECT
POLKA 4/4 - WILL NOT PLAY 3/4	- BRASS SECTION - CLARINETS - MUSETTE ACCORDION - TUBA	- SILENCES MUSETTE ACCORDION	- BRASS SECTION ONLY
COUNTRY 4/4 - WILL NOT PLAY 3/4	- STEEL GUITAR - PIANO - ACOUSTIC RHYTHM GUITAR - STRING BASS	- RHYTHM GUITAR AND STRING BASS ONLY	- NO EFFECT
JAZZ GUITAR NORMALLY 4/4 CAN PLAY 3/4	- ELECTRIC GUITAR PLAYS "JAZZ" TYPE ACCOMPANIMENT - 4 BEAT STRING BASS	- BASS CHANGES TO 2 BEAT	-CHANGES CHORDS TO BASIC CHORDS
ROCK NORMALLY 4/4 CAN PLAY 3/4	- ELECTRIC GUITAR - ELECTRIC BASS	- ADDS SYNTHESIZER SOUNDS TO ELECTRIC GUITAR	- NO EFFECT

STYLE	NORMAL	VARIATION	MINOR (BASIC) MODE
BAROQUE NORMALLY 4/4 CAN PLAY 3/4	- HARPSICHORD - ELECTRIC BASS	- HARPSICHORD ONLY (NO BASS)	- NO EFFECT
BLUEGRASS 4/4 - WILL NOT PLAY 3/4	- 5 STRING BANJO - ACOUSTIC RHYTHM GUITAR - STRING BASS	- ADDS "HOEDOWN" FIDDLE	- NO EFFECT
RHYTHM GUITAR NORMALLY 4/4 CAN PLAY 3/4	- ACOUSTIC GUITAR PLAYS STRAIGHT RHYTHM - 4 BEAT STRING BASS	- BASS CHANGES TO 2 BEAT	-CHANGES CHORD TO BASIC CHORDS
DISCO NORMALLY 4/4 CAN PLAY 3/4	- CLAVINET - ELECTRIC BASS	- ADDS BRASS SECTION	- NO EFFECT
WALTZ NORMALLY 3/4 CAN PLAY 4/4	- FULL STRING SECTION - STRING BASS	- STRING SECTION CHANGES TO ACOUSTIC GUITAR PLAYING STRAIGHT RHYTHM	-CHANGES CHORDS TO BASIC CHORDS
LATIN NORMALLY 4/4 CAN PLAY 3/4	- ELECTRIC GUITAR PLAYS BOSSA NOVA FIGURES - STRING BASS	- ELECTRIC GUITAR CHANGES TO ACOUSTIC GUITAR	- SEE ABOVE


F G A B 1 C 2 D 3 E 4 F 5 G 6 A 7 B 8 C
Whole Step
Whole Step
Half Step
Whole Step
Whole Step
Whole Step
Half Step
Root 2nd 3rd 4th 5th 6th 7th 8th
Whole Step
Whole Step
Half Step
Whole Step
Whole Step
Whole Step
Half Step
NOTE C D E F G A B C
INTER-VAL 1st Root 2nd 3rd 4th 5th 6th 7th 8th Octave

EXAMPLE OF C MAJOR SCALE


F 1 G 2 A 3 B 4 C 5 D 6 E 7 F 8 G A B C
Whole Step
Whole Step
Half Step
Whole Step
Whole Step
Whole Step
Half Step
Root 2nd 3rd 4th 5th 6th 7th 8th
KEY SIGNATURE (ALL F'S RAISED ONE HALF STEP - G SCALE)
Whole Step
Whole Step
Half Step
Whole Step
Whole Step
Whole Step
Half Step
NOTE G A B C D E F# G
INTER-VAL 1st Root 2nd 3rd 4th 5th 6th 7th 8th Octave

EXAMPLE OF G MAJOR SCALE

MAJOR SCALES -- The following procedure will construct any Major Scale.
NOTE: All keys (Black and White) must be counted.

1. The Root or First note of any scale is the key from which the scale is named, (i.e., C scale = C key or G scale = G key).
2. Count 2 physical keys (whole step) to right to arrive at 2nd
   — then —
3. Count 2 physical keys (whole step) to right to arrive at 3rd
   — then —
4. Count 1 physical key (half step) to right to arrive at 4th
   — then —
5. Count 2 physical keys (whole step) to right to arrive at 5th
   — then —
6. Count 2 physical keys (whole step) to right to arrive at 6th
   — then —
7. Count 2 physical keys (whole step) to right to arrive at 7th
   — then —
8. Count 1 physical key (half step) to right to arrive at 8th or octave.

CHORD STRUCTURE -- To make chords on any scale

CHORD NAME	STRUCTURE (STANDARD)	PLAYED ON MX1
MAJOR	Root 3rd 5th	Root
MINOR	Root 3rd Lowered One Half Step 5th	Root 3rd Lowered One Half Step
DIMINISHED	Root 3rd Lowered One Half Step 5th Lowered One Half Step	Root 5th Lowered One Half Step
AUGMENTED	Root 3rd 5th Raised One Half Step	Root 3rd 5th Raised One Half Step
7TH	Root 3rd 5th 7th Lowered One Half Step	Root 7th Lowered One Half Step (2 keys to left of Root)

1. Turn on A.O.C. Organ and A.O.C. Open Harmony tabswitches.
2. Turn off all Lower Keyboard tabswitches.
3. Turn off all Upper Keyboard tabswitches except Flute 8' tabswitch.
4. Hold C2 on Lower Keyboard for remainder of test.
5. Play C2 through C5 on Upper Keyboard.

Chart below indicates coupling which takes place.

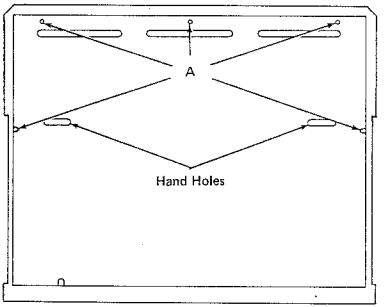
NOTES PLAYED			COUPLED	TWO NOTES
Lower	Upper		NOTE	HEARD
C2	C2		None	C2 Only
	C#2	5 KEYS	C1	C1 – C#2
	D2		C1	C1 – D2
	D#2		C1	C1 – D#
	E2		C1	C1 – E2
	F2		C1	C1 – F2
	F#2	6 KEYS	C2	C2 – F#2
	G2		C2	C2 – G2
	G#2		C2	C2 – G#2
	A2		C2	C2 – A2
	A#2		C2	C2 – A#2
	B2		C2	C2 – B2
	C3		None	C3 Only
	C#3	5 KEYS	C2	C2 – C#3
	D3		C2	C2 – D3
	D#3		C2	C2 – D#
	E3		C2	C2 – E3
	F3		C2	C2 – F3
	F#3	6 KEYS	C3	C3 – F#3
	G3		C3	C3 – G3
	G#3		C3	C3 – G#3
	A3		C3	C3 – A3
	A#3		C3	C3 – A#3
	B3		C3	C3 – B3
	C4		None	C4 Only
	C#4	5 KEYS	C3	C3 – C#4
	D4		C3	C3 – D4
	D#4		C3	C3 – D#4
	E4		C3	C3 – E4
	F4		C3	C3 – F4
	F#4	6 KEYS	C4	C4 – F#4
	G4		C4	C4 – G4
	G#		C4	C4 – G#4
	A4		C4	C4 – A4
	A#4		C4	C4 – A#4
	B4		C4	C4 – B4
	C5		None	C5 Only

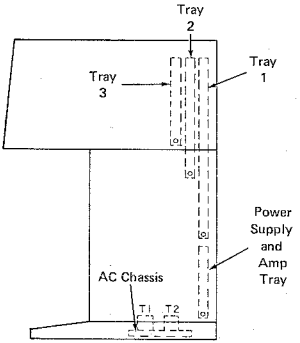
TO REMOVE BACK

1. Remove five screws marked A.
2. Grip organ back through hand holes pulling out toward you.
3. Raise organ back out of bottom channel.

TO REPLACE BACK

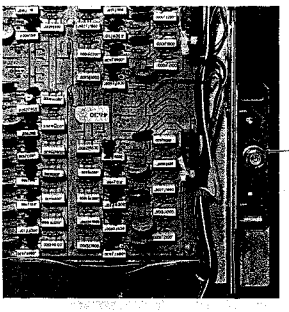
1. Raise organ back through hand holes and insert in bottom channel.
2. Push organ back into correct position and replace five screws marked A.



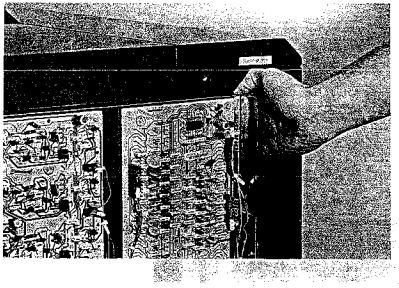


TO LOWER TRAY 1

1. Remove bolt A (2) from left and right sides of tray. (Right side shown)

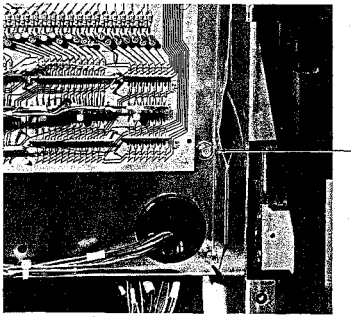


2. Placing hand as shown on top of tray, pull outward and lower into horizontal position held by straps.



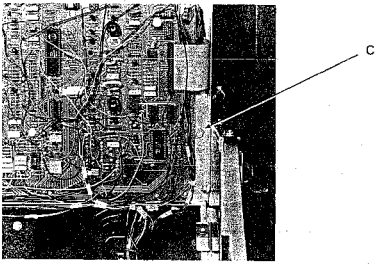
TO LOWER TRAY 2

1. Remove bolt B (2) from left and right sides of tray. (Right side shown)
2. Grasp tray edge at top, pulling outward and lower to horizontal position.



TO LOWER TRAY 3

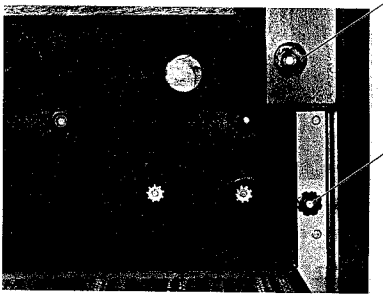
1. Remove bolt C (2) from left and right sides of tray. (Right side shown)
2. Grasp tray edge at top pulling outward and lower to horizontal position.

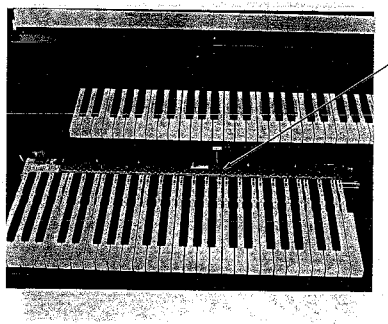


1. Remove Lowrey keyswitch rail by removing 6 Phillips screws.
2. Remove bolt C (2) located underneath keybed on left and right sides of organ. (Right side shown.)
3. Position spotlights at an angle closest to the side tab panels.
4. Lower all three circuit board trays. (See circuit board tray descriptions.) Lift and slide upper keybed toward rear of organ, being careful not to damage wiring harnesses.

   Lower keyswitches are now accessible from front of organ as shown in bottom photo.

Lower Keybed (from below, right side)





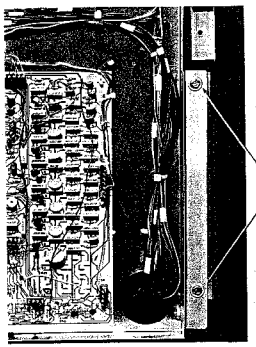


PHOTO 1

1. Remove screws E (2 each side) from both sides of tray assembly.
2. Lower Power Supply-Amplifier tray.
3. Unplug reverb unit (located above bass pedal assembly).
4. Perform Lower Keyswitch Access Procedure.
5. Remove bolt F (2). (See Lower Keyswitch Access Photo.)
6. Remove tie wraps on pedal cable (right side) and 6x9 speaker cable (left side) to gain access to side panels. Pedal light power board should be unplugged and removed from stand off. (See Photo 2.)

   CAUTION: Slide trays back slowly and observe all cabling for stress.
7. Slide entire tray assembly out, first by pulling on trays 1 and 2, then by pulling on tray assembly bracket indicated in Photo 2.

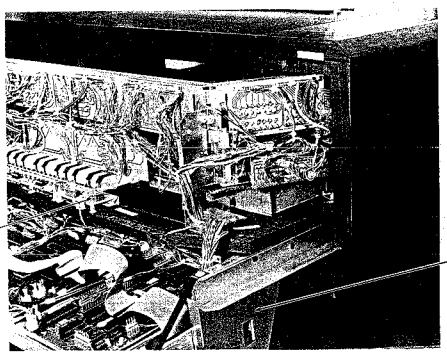
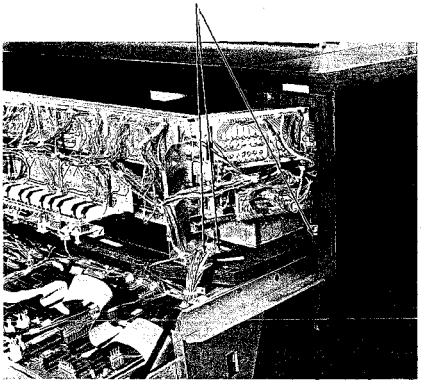


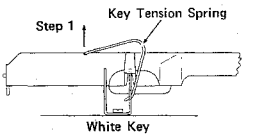
PHOTO 2

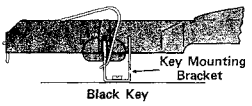
UPPER KEYS ACCESS

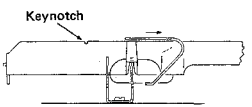
1. Perform steps listed in Side Tab Panel Access.
2. Remove three screws on each side of upper keybed.
3. Pull upper keybed toward front of organ, freeing it from tab panel, exposing upper keys for replacement.

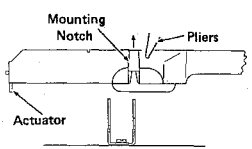
Remove these screws











KEY REMOVAL

Note: See Lower Keyswitch Access and Upper Keys Access.

1. Using long nose pliers, lift key tension spring from notch in key.
2. Slide key tension spring toward front of key, removing its ends from holes in key mounting bracket.
3. Using long nose pliers, grip key directly in front of mounting notch and lift key from key mounting bracket. In some cases, to remove a white key the adjacent black key or keys must be removed first.

KEY REPLACEMENT

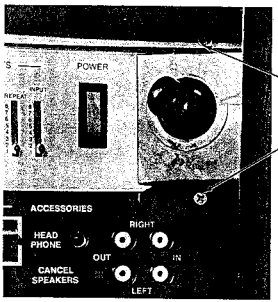
1. Push key downward onto key mounting bracket at mounting notch so that it fits snugly.
2. Place key tension spring over key forward of mounting notch.
3. Slide key tension spring toward rear so that it snaps into key notch making sure its ends fit into holes in key mounting bracket.
4. Verify that keyswitch contact is within actuator.

PEDAL LIGHT REMOVAL

1. Remove the Lower Keys C1, C#1, and D1. (See Key Removal.)
2. Grasp light assembly, turn counterclockwise and pull out.
3. Pull bulb out of socket.

PEDAL LIGHT REPLACEMENT

1. Push bulb securely into socket.
2. Push light assembly into slot, turn clockwise until securely locked.
3. Replace keys. (See Key Replacement.)



Remove these screws

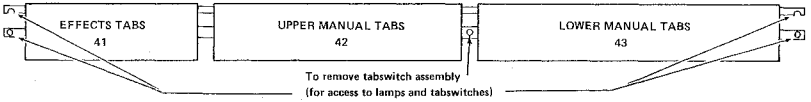
1. Remove top and bottom screws.
2. Pull socket from spot light housing.
3. Remove bulb from socket, replace with new bulb.
4. Push socket into spot light housing.
5. Replace housing with screws (light screw top, dark screw bottom).

TAB PANEL DISASSEMBLY

CAUTION: Do not remove PC Board mounting screws.

1. Put all tabs into off position.
2. Remove the five screws.
3. Carefully separate tabswitch assembly from front panel, rotating bottom of assembly toward rear of organ.

FIG. 1
Tab Panel (Rear View)



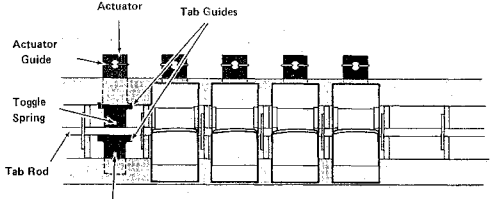


FIG. 2
Tabs in Service Position
(Upside down)

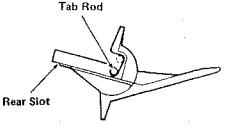


FIG. 3
Side View of Upside Down Tab

TAB REMOVAL

1. Carefully separate tabswitch assembly from front panel, rotating bottom of assembly toward rear of organ. (See Tab Panel Disassembly Fig. 1)
2. To remove tab push down firmly, releasing it from tab rod.

TAB REPLACEMENT

1. Insert tab so actuator fits between rear slot of tab and tab is positioned between tab guides on actuator.
2. Push tab forward until tab rod is positioned as shown by dotted circle in Fig. 3.
3. Push firmly upward on tab until tab rod locks into position, as shown by solid circle in Fig. 3.

PUSHBUTTON SWITCH ACCESS

Pushbutton Switch Boards are located directly above tabswitch boards, accessible from rear of tab panels. To dismantle pushbutton boards:

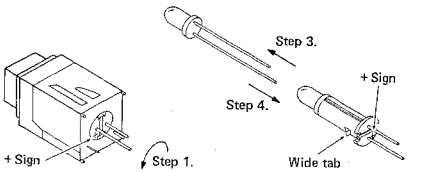
1. Disconnect the plugs from the sockets of the board to be accessed.

   NOTE: Observe the position and direction of each connector to reduce the possibility of miswiring the board upon reassembly.
2. Remove knobs from any potentiometers mounted to board being accessed.
3. Remove the mounting screws from the board.
4. Remove board from organ.
5. Unsolder potentiometer or pushbutton switch to be serviced.

To install the pushbutton board:

1. Mount board in organ and secure with the mounting screws.
2. Reconnect the plugs and insert knobs on potentiometers.
3. Test each switch and potentiometer for proper operation.

PUSHBUTTON SWITCH BULB REPLACEMENT



1. Using small screwdriver, rotate socket 1/4 turn counter-clockwise.
2. Remove bulb and socket by pulling bulb leads outward.
3. Remove bulb from socket.
4. Insert replacement bulb into socket, inserting the long bulb lead through the opening at bottom of socket indicated by the + sign.
5. Insert bulb and socket into housing, keeping wide tab of socket on left. Rotate socket 1/4 turn clockwise.
6. After socket replacement, pull on bulb leads to insure proper seating of bulb on top of socket. Improper seating can cause an inoperative switch.

PARTS ORDERING PROCEDURE

Call: (800) 323-3532. In Illinois dial 312-759-5104. The toll-free number is available 24 hours a day, 7 days a week. During working hours, it is answered by Parts Department personnel.

or

Write: LOWREY SERVICE PARTS DEPARTMENT
1300 Naperville Drive
Romeoville, IL 60441

In Canada, Call: (416) 752-6355

or

Write: LOWREY ORGAN COMPANY, LTD.,
SERVICE DEPARTMENT
124 Milner Avenue
Agincourt, Ontario, Canada M1S 9Z9

Be sure to include the following information:

1. Your name and address
2. Your account number

If you wish to have the parts billed to one address and shipped to another, it is necessary to have the full name, address and account number of the store being billed.

3. Shipping preference
4. Complete Part Number

If unknown and not in the service manual, provide a complete description of the part.

5. A brief description of the part

AVOID DELAYS BY USING COMPLETE PART NUMBERS

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BOARD 1
Orchestral Symphonizer QC

Integrated Circuits

IC1-6	LM348	991-025267-000
IC7, 8	LM13600N	991-029876-000
IC9	CD4016BE	991-028679-001
IC10, 13, 15	MC1458C	991-025244-000
IC11, 12	CA3080E	991-021444-002
IC14	SAD-512D	991-028690-000

Transistors

Q1		991-002232-000
Q2-14		991-028269-000
Q15		991-010098-000
Q16, 17		991-026617-000
Q18, 19		991-028691-000

BOARD 2
Solo Filter

Integrated Circuits

IC16-20	CD4016BE	991-028679-001
IC25	MC1458C	991-025244-000
IC26-28	LM13600N	991-029876-000

Transistors

Q25, 27-31, 33, 35, 37, 40		991-018238-000
Q26		991-028269-000
Q32, 34, 36, 38		991-010098-000
Q39		991-016727-000

BOARD 3
Main Quality Control

Integrated Circuits

IC1, 2	CA3080E	991-021444-002
IC3, 4	LM348	991-025267-000

Transistors

Q1-4, 6, 7, 9, 11, 13, 15-21, 26, 28, 29, 31, 36-38		991-028269-000
Q5, 10, 12, 27, 30, 32-35		991-018238-000
Q8, 14, 22, 23		991-026617-000
Q24, 25		991-010098-000

BOARD 4
Three Channel Chorus

Integrated Circuits

IC1	CD4069VB	991-027359-002
IC2-4	LM348	991-025267-000
IC5, 6	CD4027BE	991-026022-001
IC7-9	SAD-512D	991-028690-000

BOARD 4 (Continued)

Transistors

Q2-4		991-016727-000
Q5, 6, 9, 10, 13, 14		991-028691-000
Q7, 8, 11, 12, 15, 16		991-026315-000

BOARD 5
Two Channel Chorus

Integrated Circuits

IC1, 2, 5	MC1458C	991-025244-000
IC3, 4	SAD-512D	991-028690-000

Transistors

Q1, 2		991-016727-000
Q3-6		991-028691-000
Q7-10		991-026315-002

BOARD 6
Upper Fractional Flute Filter

Integrated Circuits

IC1	RC4136	991-022794-000

Transistors

All		991-030752-000

BOARD 7
Lower Sustain Flute Filter

Integrated Circuits

IC1, 2	RC4136	991-022794-000
IC3	MC1458C	991-025244-000
IC4, 5	CA3080E	991-021444-001

Transistors

Q2-8, 11-17, 21-34, 38-44		991-030752-000
Q46-48, 51-56		991-028269-000
Q50		991-026617-000

BOARD 8
Hawaiian Guitar

Integrated Circuits

IC1	CD4016BE	991-028679-001
IC2	CA3080E	991-021444-001
IC3	MC1458C	991-025244-000
IC4	SAD-512D	991-028690-000

Transistors

Q1, 2		991-028691-000
Q3, 4, 6		991-026315-000
Q5, 8		991-016727-000
Q7		991-030753-000

BOARD 9
Mixer

Integrated Circuits

IC1-5, 8	CA3080E	991-021444-001
IC6, 7	RC4136	991-022794-000
IC9	MC1458C	991-025244-000

Transistors

Q1, 8, 9, 11	991-026315-002
Q2-7, 19-23	991-028269-000
Q10	991-016727-000
Q12-17	991-026617-000
Q18	991-010098-000

BOARD 10
Upper Sustain Flute Filter

Integrated Circuits

IC1-4	RC4136	991-022794-000
IC5	CA3080E	991-021444-002

Photocells

P1, 2	948-022782-000

Transistors

Q1-3, 6-14, 26, 46, 48, 49	991-028269-000
Q4	991-016727-000
Q5, 17-23, 28-34, 37-43	991-030752-000
Q15, 27, 47, 50	991-010098-000
Q16	991-026315-002

BOARD 12
Solo Keyer

Coil

L1	Oscillator	952-018874-007

Diodes

D10-12, 16-19, 44, 47, 48		919-004799-050
Z1	Zener 3.9V 1/2W	919-026799-151
Z2	Zener 12V 1/2W	919-026799-165
All others		919-024769-050

Integrated Circuits

IC1-4	CD4069VB	991-027359-002
IC5-13	CD4016BE	991-028679-001
IC21	CD4001UB	991-026025-002
IC22, 23	LM348	991-025267-000
IC24	MC1458C	991-025244-000
IC29	LM311	991-028688-000
IC30	EA5068	920-025507-000
IC31	CD4081BE	991-025517-000
IC32	CD4024BE	991-028681-001

BOARD 12 (Continued)
Transistors

Q1-3,8,11,12,16,18,19,21, 25, 26	991-026315-000
Q4,14,15,22,24	991-010098-000
Q5-7, 9, 10, 17	991-016727-000
Q13	991-018238-001
Q20	991-013599-000
Q23	991-031685-000

BOARDS 13 & 14
Orchestral Symphonizer Keyers

Diodes

D2,3,6,7	919-004799-050
All others	919-024769-050

Integrated Circuits

IC1	EA5070	991-022793-000
IC2-5	UDN-2982A	991-029873-000

Network 18-Pin, 68K 949-027483-000

Transistors

Q1-34	991-026617-000
Q35	991-030753-000

BOARD 15
Keyboard Encoder

Integrated Circuits

IC1, 2	DM7407N	991-029852-000
IC3,9,29	CD4001BC	991-026025-001
IC4	CD4050BE	991-028650-001
IC5 35	DC4069UBE	991-027359-002
IC6, 21, 24, 33, 34	CD4006AE	991-026603-000
IC7, 12, 25, 32	MC14174B	991-028685-001
IC8, 16-18, 38	CD4031AE	991-026608-000

BOARD 15 (Continued)

Integrated Circuits

IC10, 13, 19, 36	CD4071BE	991-025516-000
IC11,20,23	CD4013BE	991-027358-001
IC14, 30	CD4086BE	991-026614-000
IC15,22,26,28	CD4081BE	991-025517-000
IC27, 31	CD4085BE	991-026613-000
IC37	CD4073AE	991-028684-001
IC39-41	MC14021B	991-029866-000

Transistors All 991-026315-000

BOARD 16
Orch. Symp. Tone Generator

Coil

L1	Oscillator	952-018874-007

Integrated Circuits

IC1, 3-14	CD4024BE....	991-028681-001
IC2	MK50240N ...	991-027326-000

Transistors

Q1-54,62	.....	991-026315-000
Q63	.....	991-018238-001

BOARD 17
Orch. Symp. DC Control

Integrated Circuits

IC1-6	CD4016BE	991-028679-001
IC7	CD4001UBE ...	991-026025-002
IC9	LM348.....	991-025267-000
IC10	CD4011UBE ...	991-025515-002
IC11	CD4051BE	991-029868-001
IC12	LM358.....	991-029888-000

Transistors

Q1, 4, 12, 17-20, 24-26, 28,30,32-34	.....	991-026315-000
Q2,3,11,13,15,16	.....	991-013544-000
Q5,8,31	.....	991-010098-000
Q6, 21	.....	991-016727-000
Q7	.....	991-013599-000
Q10	.....	991-030753-000
Q14	.....	991-020425-001
Q22	.....	991-010098-004
Q23, 27	.....	991-026315-002

BOARD 18
Main DC Control

Diodes

Z1	Zener 10V 5W ..	919-017406-057
All others	.....	919-024769-050

BOARD 18 (Continued)

Integrated Circuits

IC1	CD4001UBE ...	991-026025-002

Transistors

Q1,4,9,10,13, 16-20, 22-29, 32, 35, 37	.....	991-026315-000
Q2, 21, 34	.....	991-016727-000
Q3	.....	991-013544-000
Q8, 11, 30	.....	991-010098-000
Q12	.....	991-020425-001
Q14, 15	.....	991-026617-000

BOARD 19
Pedal Keyer & Filter

Integrated Circuits

IC1-3	CD4021B.....	991-029866-000
IC4	LM348.....	991-025267-000
IC5	CD4013BE	991-027358-001

Transistors

Q1,2,6,10,12,14,20, 24-26.		991-028269-000
Q3,8,16-18,22,27,29,30...		991-026315-000
Q4, 7, 15	.....	991-016727-000
Q5,9,19,23	.....	991-018238-000
Q11	.....	991-026315-002
Q13	.....	991-026617-000

BOARD 20
Main Tone Generator

Coil

Coil	Oscillator	952-018874-007

Integrated Circuits

IC1-12,14	CD4024BE	991-028681-001
IC13	MK50240N	991-027326-000

Network 17-Pin 100K ... 949-030230-000

Transistors

Q1	.....	991-018238-001
Q2	.....	991-010098-000
Q3	.....	991-026315-000

BOARD 21
Lower Sustain Keyer

Diodes

Z1	Zener 3.9V 5W..	919-017406-069
All other	.....	919-024769-050

Integrated Circuits

IC1, 2	EA5070	991-022793-000

Network 14-Pin 68K 949-022779-000

BOARD 21 (Continued)

Transistors

Q1	.....	991-020426-001
Q2-50	.....	991-030753-000
Q51	.....	991-020425-001

BOARD 22
Upper Sustain Readout

Network	14-Pin 68K	949-022779-000

BOARD 23
Upper Fractional Keyer

Integrated Circuits

IC1, 2	EA5070	991-022793-000
Networks	8-Pin 68K	949-022778-000
	14-Pin 68K	949-022779-000

Transistors

All	.....	991-026315-000

BOARD 24
Upper Sustain Keyer

Diodes

Z1	Zener 3.9V 5W..	919-017406-069
All others	.....	919-024769-050

Integrated Circuits

IC1, 2	EA5070	991-022793-000
Transistors	All	991-030753-000

BOARD 25A-25B
Orch. Plus Instrumentation

Coils

L1-3	Oscillator	952-018874-002
All others	70mh	956-018877-000

Diodes

D64, 65, 67, 68, 70	.....	919-024117-000
D66, 69, 71	.....	919-010873-005
Z1	Zener 5V 1W ...	919-031835-001
All others	.....	919-024769-050

Integrated Circuits

IC1, 2	7414N	991-029864-000
IC3	DM74121N	991-029860-000
IC4	SN74LS138N ..	991-030236-000
IC5, 11, 17, 23, 27	CD4016BE	991-028679-001
IC6, 34	MC1458C	991-025244-000
IC7, 31	LM13600N	991-029876-000
IC8, 20, 35, 36, 42	PIC	920-028279-000
IC9, 14, 15, 19, 21, 25, 33, 41, 44	CD4051BE	991-029868-001
IC10, 16, 22, 26	LM348.....	991-025267-000

BOARD 25A-25B (Continued)

Integrated Circuits

IC12, 13, 45	CD4001BE	991-026025-001
IC18, 28, 39	CD4011BE	991-025515-001
IC24	CD40103BE ...	991-029869-001
IC29	EA5076	920-030729-000
IC30,38	MC14053B	991-031061-000
IC32, 40, 43	LM393.....	991-030254-000
IC37	LM339.....	991-029874-000
IC46	SN74LS02	991-029855-000

Lamp

	GE73	939-026038-005

Networks

	9 Pin	949-030231-000
	9 Pin	949-030232-000
	9 Pin	949-030233-000

Socket

	DIP	906-031886-001

Switch

	DIP	960-031887-003

Transistors

Q1, 3, 5	991-031685-000
Q2, 4, 6, 28, 36, 41	991-013599-000
Q7, 8, 10-13	991-010098-000
Q9, 23, 24, 26, 27, 32, 34, 35, 40, 42, 43, 48	991-026315-000
Q14, 25, 31, 33, 39, 44, 45	991-016727-000
Q20-22	991-015587-000
Q29, 37, 47	991-018238-000
Q30, 38, 46	991-013544-000

BOARD 27
Repeat Flasher

Transistors

All	.....	991-016727-000

BOARD 28
Cymbal Generator

Integrated Circuits

IC1-3	MC14516B	991-031917-001
IC4	SN74LS74AN ..	991-030244-000
IC5, 6	SN74LS85AN ..	991-031918-000
IC7	ROM	920-030722-017
IC8	MC1408P8	920-031874-000
IC9	LM13600N	991-029876-000
IC10	SN74LS04N ...	991-029856-000
Transistors	All	991-010098-000

BOARD 29
Rhythm

Diodes

Z1	5V 1W	919-031835-001
All others	.....	919-024769-050

BOARD 29 (Continued)

Integrated Circuits		
IC1-5	RC4136	991-022794-000
IC6	MM5837N	991-024108-000
IC7	PIC	920-028279-000
IC8, 9	CD4081BE	991-025517-000
Lamp	GE 73	939-026038-005
Socket	14-Pin Ribbon ..	906-031886-002
Transistors		
Q1	.....	991-016727-000
Q4, 7, 9-13, 15-18, 21	...	991-026315-002
Q8	.....	991-010098-000
Q22, 23	.....	991-018238-000
Q24	.....	991-028269-000

BOARD 30
Parallel Input-Output

Crystal	4MHz	921-032695-000
Diode		
Z1	5V 1W	919-031835-001
Integrated Circuits		
IC1, 39	SN74LS04N ...	991-029856-000
IC2	EA5076	920-030729-000
IC4	SN74LS377N ..	991-031834-000
IC6-12	PIC	920-028279-000
IC13	74LS27N	991-030720-000
IC14	DM74LS154N ..	991-029861-000
IC15	SN74LS155	991-030253-000
IC16, 17	F-7414PC	991-029864-000
IC18-32	ULN-2004A....	991-029872-000
IC36-38	MC14511B.....	991-029859-000
Lamp	GE 73	939-026038-005
Socket	14-Pin Ribbon ..	906-031886-002

BOARD 31
ROM

Diodes		
Z1	5V 1W	919-031835-001
Integrated Circuits		
IC1	ROM	920-030722-002
IC2	ROM	920-030722-003
IC3	ROM	920-030722-004
IC4	ROM	920-030722-005
IC5	ROM	920-030722-006
IC6	ROM	920-030722-007
IC7	ROM	920-030722-008

BOARD 31 (Continued)
ROM

Integrated Circuits		
IC8	ROM	920-030722-009
IC9	ROM	920-030722-010
IC10	ROM	920-030722-011
IC11	ROM	920-030722-012
IC12	ROM	920-030722-013
IC13	ROM	920-030722-014
IC14	ROM	920-030722-015
IC15	ROM	920-030722-016
IC17	DM74LS154N ..	991-029861-000
IC18	DM74LS02N ...	991-029855-000
IC19	74LS240N	991-031063-000
IC20, 21	74LS244N	991-031060-000
IC22	DM74LS04N ...	991-029856-000
Network	11-Pin 10K.....	949-030275-000
Socket	DIP	906-031866-003
Switch	DIP	960-031887-008

BOARD 32
Central Processing Unit (CPU)

Crystal	6MHz	921-029879-000
Diodes		
Z1	5V 1W	919-031835-001
All others	.....	919-024769-050
Integrated Circuits		
IC1	P8085A	920-029846-000
IC2, 7	74LS244N	991-031060-000
IC3,4,10	7414N	991-029864-000
IC5	P8212	920-029847-000
IC6	74LS240N	991-031063-000
IC8	SN74LS138N ..	991-030236-000
IC9	DM74LS32N ...	991-030721-000
IC11	74150N	991-029853-000
IC12	SN74LS00N ...	991-029854-000
IC13-15	MM80C95N	991-029862-000
IC20	MK4118N	920-030708-000
IC24, 25	SIC	920-028278-000
IC27	74LS10N	991-029858-000
IC29	DM74LS154N ..	991-029861-000
IC31	SN74LS74AN ..	991-030244-000
IC32	MM74C14N	991-025576-000
Transistor		
Q1	.....	991-002232-000

BOARD 33
Golden Harp Button

Potentiometers	Controls	
Percuss	1M Log. Rev. . .	925-030262-005
Sustain	10K Lin.	925-030262-001
Reverb	10K Log.	925-030262-002
Repeat	10K Log.	925-030262-002
Input	10K Log. Dual . .	925-030267-001

BOARD 34
Solo Symp. Button

Potentiometers	Controls	
Tuning	25K Lin.	925-030262-003
Trem Depth	10K Lin. . .	925-030262-001
Trem Speed	100K Log.Rev.	925-030262-004
Volume	10K Log.	925-030262-002

BOARD 35
Custom Symp. Button

Potentiometers	Controls	
Filter Tune		
100K Log. Dual Rev. . .		925-030267-005
Filter Resonance		
25K Log. Dual		925-030267-003
Filter Range		
25K Log. Dual		925-030267-003
Envelope Attack		
175K Log. Dual		925-030267-006
Envelope Decay		
1M Log. Dual		925-030267-007
Envelope Sustain		
10K Log. Dual		925-030267-001

BOARD 36
Orch. Symp. Button

Potentiometers	Controls	
Upper	10K Log.	925-030262-002
Lower	10K Log.	925-030262-002
Pedal	10K Log.	925-030262-002
Tuning	25K Lin.	925-030262-003
Trem Depth	10K Lin. . .	925-030262-001
Trem Speed	100K Log. Rev.	925-030262-004
Volume	10K Log.	925-030262-002

BOARD 37
Rhythm Button

Potentiometers	Controls	
Rhythm Volume		
10K Log. Dual		925-030267-001

BOARD 37 (Continued)

Potentiometers	Controls	
Rhythm Speed		
10K Lin. Dual		925-030267-002
Orchestration		
10K Log. Dual		925-030267-001
Genie		
10K Log.		925-030262-002

Slide Switch	Rhythm Speed	960-030247-000

BOARD 38
Flute Preset Potentiometer

Potentiometers	Controls	
All	10K Log.	925-030262-002

BOARD 39
Headphone Jack

Jacks	Headphone	910-031034-000
	Out, In	910-031035-001
Socket	Pushbutton Switch	906-031913-000
Switch	Pushbutton	960-031875-013

BOARD 41
Effects Tab

Transistor	Q1	991-026815-002

BOARD 44
Digital Readout

Diode		
Digital Display	7 Segment	919-031873-000
Socket		
Digital Display	14-Pin. . .	906-030238-000

BOARDS 45, 46, 48 & 49
Upper & Lower Keyswitch

Contacts	Adjustable	918-030271-000
	Spring	917-030509-000

Integrated Circuits		
All	MC14021B	991-029866-000

BOARD 50
Regulator

Diodes		
D1-3	. . . . .	919-024769-050

BOARD 50 (Continued)

Diodes		
D4	.....	919-010459-000
D5	.....	919-010623-000
Z1	9.1V 5W	919-017406-026
Z2, 3	3.3V 5W	919-017406-018
Z4, 7	15V 1/2W	919-026799-068
Z5	15V 5W	919-017406-013
Z6	18V 5W	919-017406-003
Z8	30V 1/2W	919-026799-079
Clip	Fuse	976-026063-000
Fuse	6-Amp Fast-Blo .	939-001197-004
Integrated Circuits		
All	LM723	991-029875-000
Relays		
K1	4-PDT	921-024167-000
K2	2-PDT	921-029096-000
Transistors		
Q5	.....	991-020426-001
Q6	.....	991-026315-002
Q7, 8	.....	991-026617-000

BOARD 51
Crossover

Integrated Circuits		
IC1	CA3080E	991-021444-001
IC2	MC1458C	991-025244-000
Transistors		
Q4	.....	991-026315-000
Q5-9	.....	991-018238-000

BOARDS 52-57
Amplifiers

Clip	Fuse	976-026063-000
Fuse	3-Amp Fast-Blo .	939-001197-003
Lamp	GE 73	939-026038-005
Transistors		
Q10-12	.....	991-026617-000
Q13	.....	991-015614-000
Q16	.....	991-013544-000

BOARD 58
AC Distribution

Clip	Fuse	976-026063-000

BOARD 58 (Continued)

Diodes		
D1-6	.....	919-010459-000
D7	.....	919-010623-000
Fuses	3-Amp Fast-Blo .	939-001197-003
	5-Amp Slo-Blo ..	939-013304-004
	6-Amp Fast-Blo .	939-001197-004
Relay	SPST	921-031617-000
Thermister	.....	921-031871-000

BOARDS 59 & 60
Pedalswitch

Contacts	Bus Bar	918-029537-001
	Spring	917-030494-000
Holder	Bus Bar	964-030791-000

AC CHASSIS ASSEMBLY

Cord	Power	989-008717-000
Diodes		
All	Bridge Rectifier, 30-Amp	919-029090-000
Transformers		
T1	.....	954-031889-000
T2	.....	945-031832-000

BASS PEDAL ASSEMBLY

Actuator	Pedalswitch	964-030990-000
Caps	Natural	978-031881-000
	Sharp	915-003863-000
Channels	Natural	966-005102-010
	Sharp	966-005103-008
Spring	Compression ...	975-005811-000

BENCH ASSEMBLY

Bench	Walnut	978-031989-001

CONSOLE ASSEMBLY

Console	Walnut	978-029588-001
Endblocks	Walnut	
Upper	Left Hand	978-029575-002
	Right Hand	978-029574-002
Lower	Left Hand	978-029577-002
	Right Hand	978-029576-002

CONSOLE ASSEMBLY (Continued)

Lamp		
Bass Pedal	GE 70 ..	939-026038-004
Lens		
Bass Pedal	.....	922-029251-000
Rack	Music	978-026308-000
Rail	Upstop	936-031921-000
Socket		
Lamp	Bass Pedal	906-029256-000
Spring	Reverb Unit	984-017447-000
Speakers		
Bass	10-inch 8-ohm ..	985-031928-000
Chorus	6x9-inch 8-ohm .	985-031994-000
Flute & Main	8-inch 8-ohm ...	985-003185-004

EXPRESSION SHOE ASSEMBLY

Contacts	Bus Bar	918-004399-001
	Spring	917-029542-000
Diffuser	White	922-015938-001
Glide Switch	Assembly	997-030835-000
Lamp	GE 70	939-026038-004
Minor Switch	Assembly	997-030837-000
Pedal/Mat	Assembly	997-030391-000
Photocell	P1	948-029970-000
Shield	Light	922-029976-000
Socket	Lamp	906-029256-001
Spring	Compression ...	975-022949-000

POWER SUPPLY & AMPLIFIER TRAY

Insulators	IC/Transistor ...	908-002346-001
Integrated Circuits		
+8 Volt Reg.	LAS 1608..	992-031880-003
+15 Volt Reg.	LAS 1612..	992-031880-005
+39 Volt Reg.	LM340-24K	992-024149-014
-15 Volt Reg.	LM320-15K	992-026646-010
Transistors		
Q1-4, 14	.....	992-026039-002
Q15	.....	992-026040-002
Q17	.....	992-026315-001

TAB PANEL ASSEMBLY

Diodes	All	919-021084-000
Halogen Lamp Assembly		
Left Hand	.....	997-032120-000
Right Hand	.....	997-032119-000
Knobs		
Controls	Black	915-030496-006
	Brown	915-030496-007
	Red	915-030496-001
	Yellow	915-030496-002
	Green	915-030496-003
	Blue	915-030496-004
	White	915-030496-005
Switches	Black	915-030496-006
Lamps		
Halogen	GE773	939-031839-000
Tab Panel	GE73	939-026038-002
Lens	Cancel Accomp.	922-027397-012
	Cancel Accomp.. Insert	922-029581-012
Socket		
Lamp	Tab Panel	906-030110-001
Switches	Cancel Accomp..	960-029224-000
	Lights	960-031830-000
	Power	960-028213-002

TABSWITCH ASSEMBLY

Contacts	Bus Bar	918-029537-001
	Spring	917-030494-000
Guide	Slider	976-030904-000
Holder	Bus Bar	964-030791-000
Lamp	GE73	939-026038-002
Pusher	Medium	964-025555-000
Tabs		
Bass	Pedal Sustain ...	915-025544-251
	Pedal 16	915-025544-252
	Pedal 8	915-025544-253
	Diapason 8	915-025544-254
	Diaphone 16 ...	915-025544-255
	Guitar Bass.....	915-025544-256
	Bass Medium ...	915-025544-257
	Bass Full	915-025544-258
Magic Genie	Genie Bass	915-025544-261
	Bass Plus	915-025544-308
	Magic Genie Chords	915-025544-263
	Magic Key Memory	915-025544-264

TABSWITCH ASSEMBLY (Continued)

Lower	Piano	915-025544-269
	Guitar	915-025544-270
	Banjo	915-025544-271
	Diapason 8	915-025544-272
	Vox Humana 8	915-025544-273
	Flute 8	915-025544-274
	Flute 4	915-025544-275
	Flute 2	915-025544-276
	Lower Med.	915-025544-259
	Lower Full	915-025544-260
Upper	Trombone 16	915-025544-286
	Clarinet 16	915-025544-287
	Cornet 16	915-025544-288
	Kinura 8	915-025544-289
	Flute 16	915-025544-277
	Flute 8	915-025544-274
	Flute 5-1/3	915-025544-279
	Flute 4	915-025544-275
	Flute 2-2/3	915-025544-281
	Flute 2	915-025544-276
	Flute 1	915-025544-283
Presets	Upper Flute Preset	915-025544-265
	Custom Flute Preset	915-025544-213
Effects	Sustain Upper	915-025544-292
	Sustain Lower	915-025544-293
	Upper String Attack	915-025544-294
	Marimbo Repeat	915-025544-295
	Vibrato	915-025544-296
Harmony	AOC Organ	915-025544-297
	AOC Symphonic	915-025544-298
	AOC Open Harmony	915-025544-299
Percussion	Percuss Long	915-025544-267
	Repeat Percuss	915-025544-268
Stereophaze	Vibra Trem Flutes	915-025544-284
Sound	Flute Chorus	915-025544-285
	Main Chorus	915-025544-290
	Chorus Celeste	915-025544-291
Shaft	Tabswitch	974-009804-023
Socket		
Lamp	Tabswitch	906-031831-000
Spring	Toggle	975-031997-001

UPPER/LOWER KEYBOARD ASSEMBLY

Actuator	Keyswitch	964-030504-000
Bumper	Upstop	916-026019-000
Guide	Natural	916-026009-000
	Sharp	916-026009-002

UPPER/LOWER KEYBOARD ASSEMBLY (Continued)

Keys	Black	964-030251-000
	White A	964-030250-001
	White B	964-030250-002
	White C	964-030250-003
	White D	964-030250-004
	White E	964-030250-005
	White F	964-030250-006
	White G	964-030250-007
	White High C	964-030250-010
	White High F	964-030250-009
Spring	Key Tension	975-032268-000

GENERAL

Cable		
Ribbon	14 Conductor	957-031838-000
	40 Conductor	957-031837-000
Capacitors	Electrolytic	
	1 uf 35V	945-030702-004
	1 uf 50V	945-026783-014
	1 uf 50V NP	945-028285-003
	2.2 uf 25V	945-026783-001
	2.2 uf 63V	945-026783-017
	2.2 uf 16V NP	945-028285-002
	3.3 uf 25V	945-026783-015
	3.3 uf 16V NP	945-028285-001
	4.7 uf 16V	945-026783-002
	4.7 uf 35V	945-030702-003
	4.7 uf 63V	945-026783-018
	10 uf 16V	945-026783-004
	10 uf 25V	945-026783-010
	10 uf 100V	945-026783-020
	22 uf 16V	945-026783-016
	22 uf 25V	945-026783-005
	22 uf 50V	945-030702-005
	22 uf 63V	945-026783-019
	47 uf 25V	945-026783-021
	100 uf 16V	945-026783-006
	100 uf 35V	945-026783-007
	220 uf 16V	945-026783-012
	470 uf 16V	945-026783-011
	470 uf 63V	945-026783-028
	1000 uf 35V	945-026783-026
	2200 uf 63V	945-030278-004
	4700 uf 50V	945-030278-003
	10,000 uf 16V	945-030278-001

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Capacitors	Tantalum	
	.47 uf 35V	946-012624-474
	.68 uf 35V	946-012624-684
	.82 uf 25V	946-021452-003
	1 uf 35V	946-021452-002
	2.2 uf 35V	946-012624-225
	5.6 uf 25V	946-021452-001
	10 uf 15V	946-021452-008
	22 uf 16V	946-021452-010
Diodes		
LED	Amber	919-030266-003
	Green	919-030266-005
	Red	919-030266-002
	Yellow	919-030266-004
	Red/Green	919-031836-000
All others	.....	919-024769-050
Posts	PCB Mounting	
AC Chassis	.....	964-029299-004
Shelf	.....	964-032257-000
Trays	1, 2, 3	964-029299-002
Amp & Power Supply	....	964-031915-005
Potentiometers	Adjustment	
	5K	925-030239-004
	10K	925-030239-005
	25K	925-030239-006
	50K	925-030239-007
	100K	925-030239-008
	500K	925-030239-010
Resistors	WW	
	.1 ohm 5W	924-031689-002
	.18 ohm 2W	924-008896-021
	.18 ohm 5W	924-008896-029
	1 ohm 5W	924-031689-003
	1.5 ohm 50W ...	924-030240-001
	2 ohm 5W	925-031689-004
	2.5 ohm 10W ...	924-031919-001
	4 ohm 5W	924-008896-049
	4.7 ohm 2W	924-010471-047
	15 ohm 2W	924-010471-150
	18 ohm 10W ...	924-031919-003
	25 ohm 10W ...	924-031919-002
	47 ohm 2W	924-010471-470
	68 ohm 5W	924-008896-009
	100 ohm 2W ...	924-010471-101
	150 ohm 2W ...	924-010471-151
	470 ohm 2W ...	924-010471-471

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Sockets		
Connectors	Rear Entry	
	3-pin.....	906-032248-003
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	6-pin.....	906-032248-006
	7-pin.....	906-032248-007
	8-pin.....	906-032248-008
	9-pin.....	906-032248-009
	10-pin	906-032248-010
	11-pin	906-032248-011
	12-pin	906-032248-012
	13-pin	906-032248-013
	14-pin	906-032248-014
	15-pin	906-032248-015
	Side Entry	
	3-pin.....	906-030992-003
	5-pin.....	906-030992-005
	6-pin.....	906-030992-006
	8-pin.....	906-030992-008
	Top Entry	
	3-pin.....	906-030148-003
	4-pin.....	906-030148-004
	5-pin.....	906-030148-005
	6-pin.....	906-030148-006
	7-pin.....	906-030148-007
	8-pin.....	906-030148-008
	9-pin.....	906-030148-009
	10-pin	906-030148-010
	11-pin	906-030148-011
	12-pin	906-030148-012
	13-pin	906-030148-013
	14-pin	906-030148-014
	15-pin	906-030148-015
Integrated Circuits		
	8-pin	906-021448-000
	14-pin	906-018905-000
	16-pin	906-018905-001
	18-pin	906-018905-004
	20-pin	906-018905-005
	24-pin	906-018905-002
	40-pin	906-022727-000
Switches	Amber	960-031875-008
	Blue	960-031875-007
	Clear	960-031875-004
	Green	960-031875-005
	Purple	960-031875-010
	Red	960-031875-003
	Smoke Brown ..	960-031875-009
	Smoke Grey	960-031875-006
	Yellow	960-031875-001

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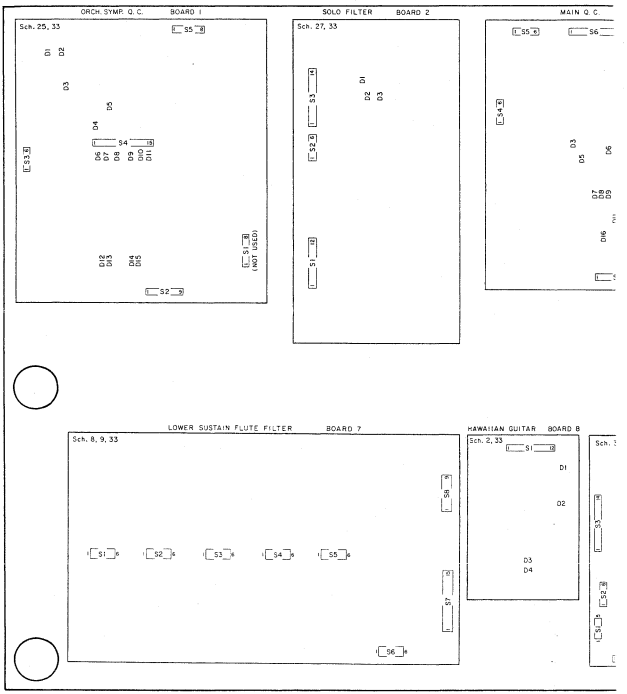
BOARD LOCATION

TRAY 1 UP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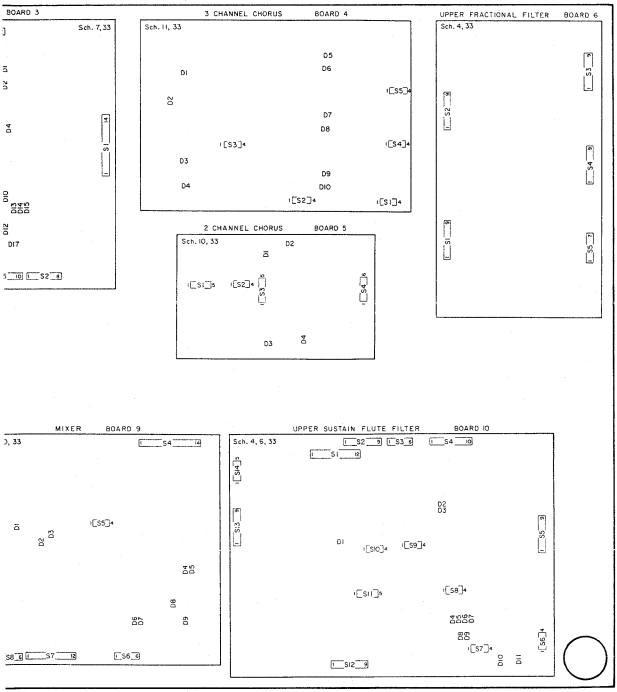
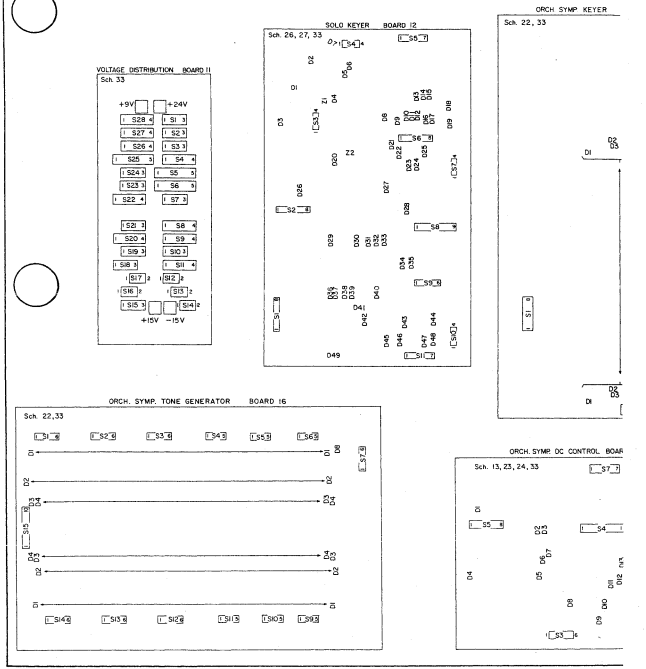
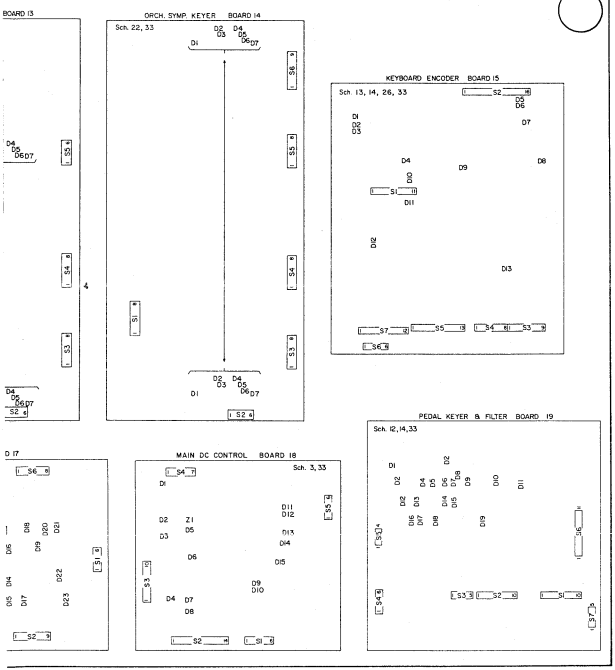
BOARD LOCATION

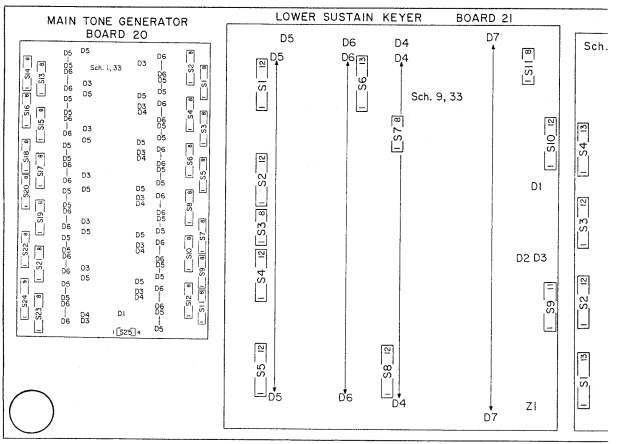


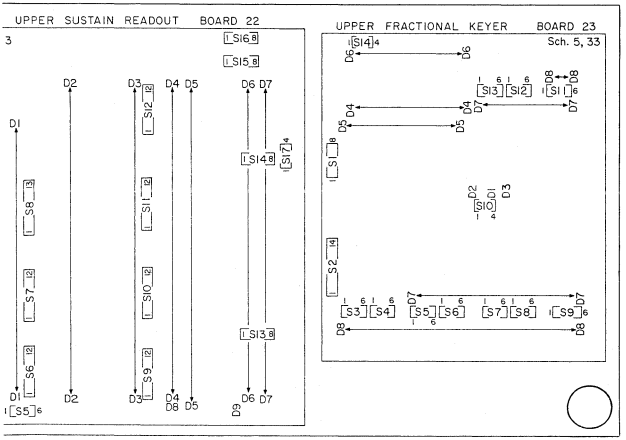
TRAY 1 DOWN


VOLTAGE DISTRIBUTION BOARD I1
Sch. 33
+9V
+24V
S28
S1
S27
S2
S26
S3
S25
S4
S24
S5
S23
S6
S22
S7
S21
S8
S20
S9
S19
S10
S18
S11
S17
S12
S16
S13
S15
S14
+15V
−15V
SOLO KEYER BOARD I2
Sch. 26, 27, 33
ORCH SYMP KEYER
Sch. 22, 33
ORCH. SYMP. TONE GENERATOR BOARD I6
Sch. 22,33
ORCH. SYMP. OC CONTROL BOAR
Sch. 13, 23, 24, 33

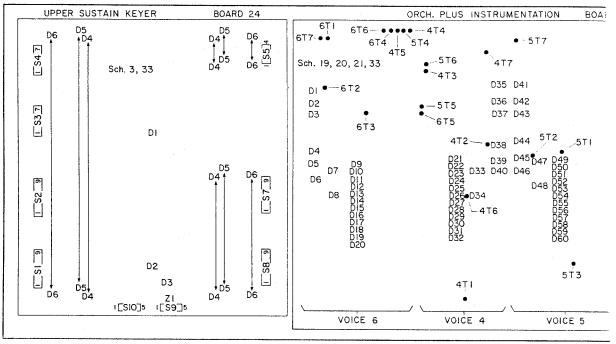

BOARD 13
ORCH. SYMP. KEYER BOARD 14
Sch. 22, 33
KEYBOARD ENCODER BOARD 15
Sch. 13, 14, 26, 33
PEDAL KEYER & FILTER BOARD 19
Sch. 12, 14, 33
MAIN DC CONTROL BOARD 18
Sch. 3, 33
D 17

TRAY 2 UP

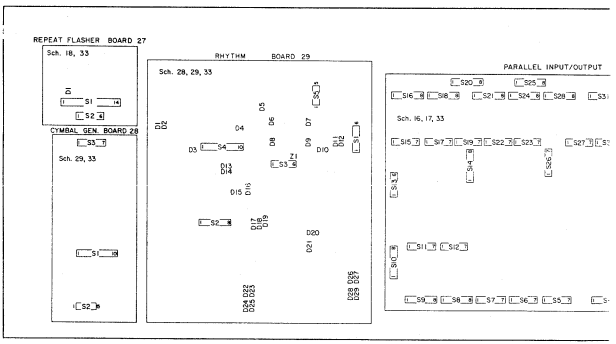

MAIN TONE GENERATOR
BOARD 20
Sch. 1, 33
LOWER SUSTAIN KEYER
BOARD 21
Sch. 9, 33
D5
D6
D4
D7
D1
D2 D3
Z1
Sch.


UPPER SUSTAIN READOUT BOARD 22
UPPER FRACTIONAL KEYER BOARD 23
Sch. 5, 33

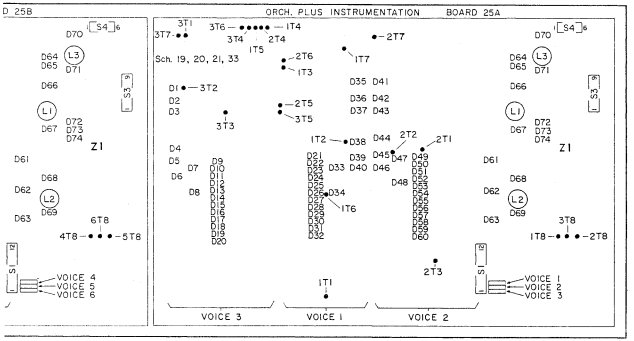
TRAY 3 UP

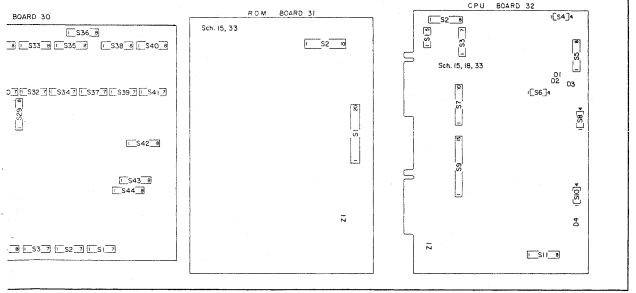


TRAY 3 DOWN

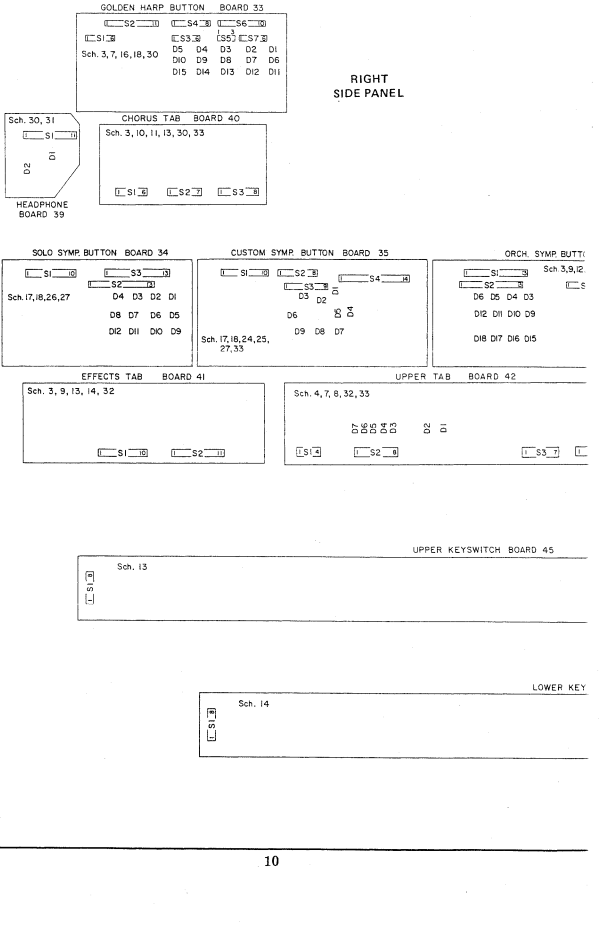


BOARD LOCATION

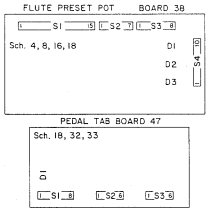


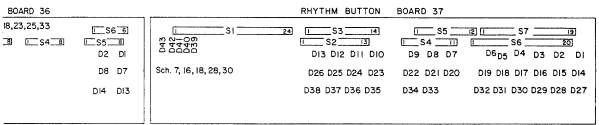


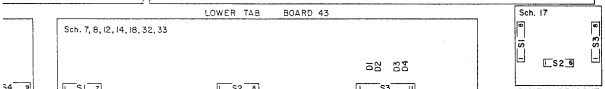
BUTTON, TAB & KEYSWITCH BOARDS

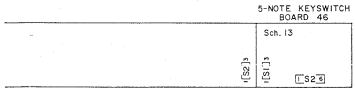


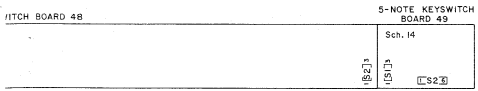
LEFT
SIDE PANEL



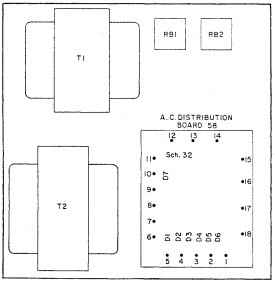




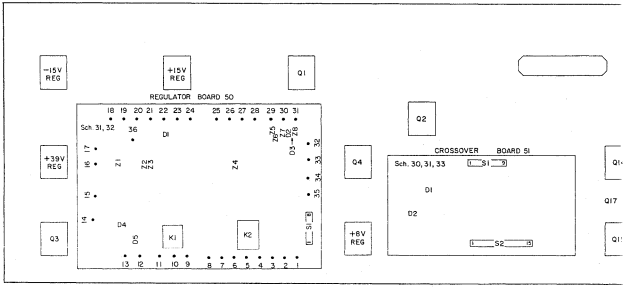




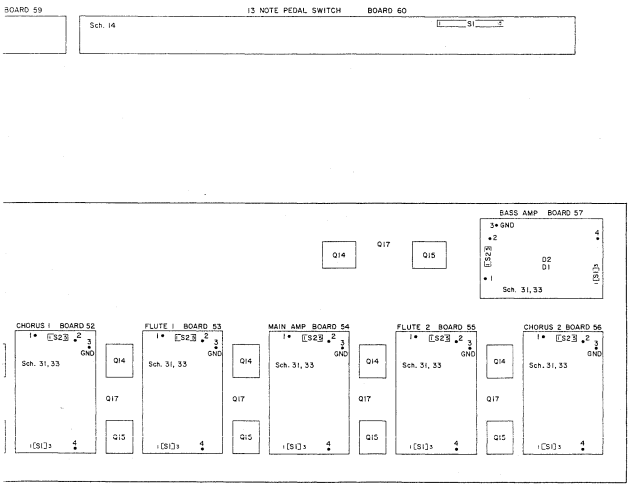
AC CHASSIS & PEDAL SWITCH BOARDS



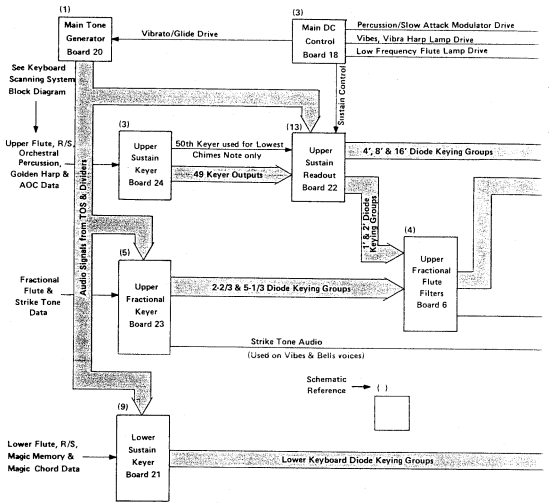
5 NOTE PEDAL SWITCH
Sch. 14 S1



POWER SUPPLY & AMP TRAY DOWN


BOARD 59
13 NOTE PEDAL SWITCH BOARD 60
Sch. 14
S1
BASS AMP BOARD 57
3 GND
2
1
S23
S1
D2
D1
Sch. 31, 33
Q14
Q17
Q15
CHORUS 1 BOARD 52
FLUTE 1 BOARD 53
MAIN AMP BOARD 54
FLUTE 2 BOARD 55
CHORUS 2 BOARD 56
GND
Sch. 31, 33

UPPER/LOWER KEYBOARD

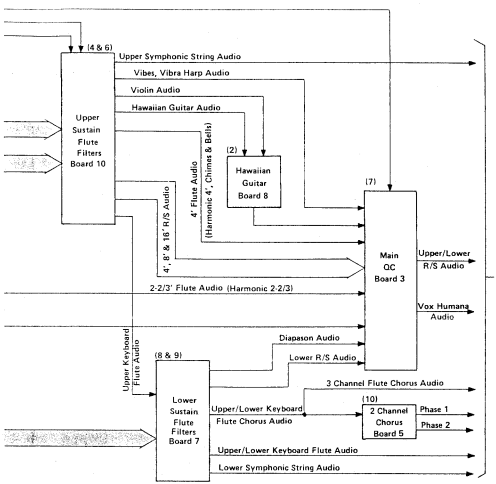

(1)
Main Tone Generator Board 20
Vibrato/Glide Drive
(3)
Main DC Control Board 18
Percussion/Slow Attack Modulator Drive
Vibes, Vibra Harp Lamp Drive
Low Frequency Flute Lamp Drive
See Keyboard Scanning System Block Diagram
Sustain Control
(3)
Upper Sustain Keyer Board 24
50th Keyer used for Lowest Chimes Note only
49 Keyer Outputs
(13)
Upper Sustain Readout Board 22
4', 8' & 16' Diode Keying Groups
Upper Flute, R/S, Orchestral Percussion, Golden Harp & AOC Data
Audio Signals from TG6 & Dividers
1' & 2' Diode Keying Groups
(4)
Upper Fractional Flute Filters Board 6
(5)
Upper Fractional Keyer Board 23
2-2/3 & 5-1/3 Diode Keying Groups
Fractional Flute & Strike Tone Data
Strike Tone Audio
(Used on Vibes & Bells voices)
Schematic Reference
( )
(9)
Lower Sustain Keyer Board 21
Lower Keyboard Diode Keying Groups
Lower Flute, R/S, Magic Memory & Magic Chord Data

UPPER/LOWER KEYBOARD
[Schematics 3, 5 & 9]

UPPER KEYBOARD

Data for keying the upper keyboard voices is produced by the keyboard scanning system and the keyboard encoder. (See keyboard and pedal scanning system block diagram.) This positive data is routed to the upper keyboard Decoders IC1 and IC2 (3-B9) where it is shifted into IC1 and IC2 by the scan clock at pin 2. At time point 67 the data is lined up at its correct position and a strobe pulse occurs causing the outputs where data appears to switch to a tri-state condition. When an output switches to a tri-state condition, the 15K pulldown resistor at the base of the PNP keyers Q1-Q49 (3-B9) causes the keyer to turn on, supplying voltage to the upper diode readout circuits (3-C11). This voltage also charges a 47 uf sustain capacitor. The discharge time of this capacitor is controlled by varying the voltage on the base of Q11 (3-E10), the more positive this base voltage the longer the sustain envelope. The voltage applied to the readout circuits allows audio signal from the tone generators to pass, forming the 1-, 2-, 4-, 8- and 16-foot diode keying groups. The 1- and 2-foot groups are routed to the Upper Fractional Flute Filter Board where the 1- and 2-foot flute filters are located. The 4-, 8- and 16-foot groups are routed to the Upper Sustain Flute Filter Board. Each footage including the fractional footages are filtered to produce the 7 upper keyboard flute footages. The output of each set of filters is routed to a preamp (4-F2). The output of each preamp is routed to a flute switcher and to a Custom Preset Volume Control. (The output of the

(Affects the following Organ Sections: All Upper/Lower Keyboard Tabswitch Voices, Symphonic String Button and Orchestral Percussion Button Sections.)



2-2/3- and 4-foot flute preamps are also routed to the Main QC to produce the harmonic 2-2/3- and 4-foot, chimes and bell voices.) Selecting a flute tabswitch allows this signal to pass to the upper keyboard Flute Mixing Preamp IC4C (4-B5). If the Custom Flute preset tab is on, the Flute tabswitch voltage is removed and Switcher Q6 (4-C2) is turned on allowing Flute audio to pass through the Custom Preset Volume Controls. All upper keyboard flute signal is combined by IC4C (4-B5) before being routed to the Lower Sustain Flute Filter Board where upper and lower keyboard flute signal is combined by the Flute Mixing Preamp IC1D (8-A3). The combined upper and lower flute audio is routed to the output mixer and also to the 2-channel chorus board. Turning on the Vibra Trem tabswitch (30-F5) allows the phase 1 and 2 outputs from the 2-channel chorus board to pass through Switcher Q6 & Q7 (30-E7) to the Flute 1 and 2 Output Amps Q12 & Q13 (30-E12). Turning on the Flute Chorus tabswitch (30-H2 & 30-F5) also allows the flute audio to pass through IC7A (30-G6) to the three channel chorus circuit (11-H9). The phase 1, 2 & 3 outputs of the 3-channel chorus modulator are then routed to the chorus 1 & 2 & main output amps (30-E12) producing a total of five chorus channels.

The 4- & 8-foot diode groups are also routed to the upper symphonic string filters (Dwg. 6) where the violina and viola voices are created. The audio for the cello symphonic string voices is taken from the output of the 16-foot Harmonic Mixers IC1C (4-E10) which is a combination of the 4-, 8- & 16-foot R/S signals. The upper symphonic string audio is routed through preamp IC4B (6-B2) to

modulator IC5 (6-B3) where the signal is volume controlled before being routed through Q4 (4-A3) to the output mixer. At the output mixer the signal is routed through the chorus audio mixer IC7A (30-G6) to the 3-channel chorus circuit (11-H9). The phase 1, 2 and 3 outputs from the 3-channel chorus are then routed into the Chorus 1 & 2 and Main Volume Regulators (30-B9). The string audio at the output of IC4B (6-B2) is also routed to Squelch Amplifier IC6B (30-G6). This signal is rectified and used to turn off Squelch Switchers Q8, 9 & 10 (30-G10) allowing the Phase 1, 2 & 3 chorus output audio to pass.

The 4-, 8- & 16-foot R/S signals are created by combining the diode keying groups through resistors at the inputs of the 4-, 8- & 16 R/S Preamps (4-G6, 9 & 10). The output of the 4-foot R/S Preamp IC2B (4-G6) is routed to the Hawaiian Guitar board (2-G2). This signal is phase modulated then routed to the main QC where it is filtered to produce the Orchestral Percussion Violin voice. The output of the 8-foot R/S Preamp IC2C (4-G9) is also routed to the Hawaiian Guitar board (2-G1). The signal is phase modulated then routed to the main QC where it is filtered to produce the Orchestral Percussion Hawaiian Guitar voice. The output of the 16-foot R/S Preamp IC3A (4-G10) is routed to the main QC (7-G5) and filtered to produce the Orchestral Percussion Accordion voice and the Clarinet tabswitch voice. The 4- and 8-foot R/S signals are combined by 8-foot Harmonic Mixers IC1A&B (4-E9). The output of the mixer is routed to the main QC (7-G3) where the audio is filtered to produce the Orchestral Percussion Accordion voice and the Kinura tabswitch voice. The 4-, 8- & 16-foot R/S signals are combined by the 16-foot Harmonic Mixers IC1C&D (4-E10). The output of the mixer is routed to the main QC (7-G7) where the audio is filtered to produce the Cornet and Trombone tabswitch voices. This audio is also routed on board to the Cello switcher (6-E1) and is used for the upper symphonic string cello voice. All upper and lower R/S audio is combined by the R/S Mixing Preamps IC3C&D (7-A5) and routed to the output mixer (30-D4) where the higher R/S frequencies are channeled to the Flute 1 Volume Regulator IC1 (30-D11) the remaining R/S frequencies are channeled to the Main Volume Regulator IC3 (30-E11). Turning on the Main Chorus tabswitch (30-E5) channels the R/S audio into the Chorus Audio Mixer IC7A (30-G6) where it is routed to the 3-channel chorus circuit (11-H9) and gives the R/S voices a chorus effect.

FRACTIONAL FLUTE AND STRIKE TONE

The data for keying the above voices is produced by the keyboard scanning system and the keyboard encoder. (See keyboard and pedal scanning system block diagram.) The fractional flute and strike tone data is inverted data which is routed to the Fractional Flute and Strike Tone Decoders IC1 & IC2 (5-H1) where it is shifted into IC1 & IC2 by the scan clock at pin 2. At time point 67 the data is lined up at its correct position and a strobe pulse occurs causing the outputs where data appears to switch high (+23V). The first 49 positions of IC1 and IC2 are used to key the fractional flute audio signals. When one of these outputs switches high, a positive voltage is applied to a 2-2/3 and 5-1/3 keying diode allowing audio signal from the tone generators to pass forming the 2-2/3 and 5-1/3 diode keying groups. The 2-2/3- and 5-1/3-foot diode keying groups are routed to the upper fractional flute filter board (4-H4) where the audio signal is filtered to produce the 2-2/3- and 5-1/3-foot Flute voices. The audio signal for each footage is then routed through a preamp (4-F4&5) to the upper sustain flute filter board where it is combined with the other upper flute footages and channeled as previously described under the upper keyboard heading.

The last twelve positions of IC1 & IC2 produced the strike tone frequency that is used for the Bells and Vibes voices. With the Bells or Vibes on, a positive voltage (+23V) is applied through a strike tone keyer transistor (5-D2) to a keying diode allowing audio signal to pass to the strike tone filter (7-F2). The strike tone frequency is a semi-tone different from the key being played. For example, playing any C on the keyboard keys a B8 octave frequency for the strike tone frequency. A chart is shown on Dwg. 5 which indicates the octave frequency being used for each keyboard note played. Turning on the Bells or Vibes allows the filtered strike tone frequency to pass through preamps IC4B&A (7-C1&B3) to the R/S Mixing Preamps IC3C&3D (7-A5) where it is combined with the other upper R/S voices and channeled as previously described under the upper keyboard heading.

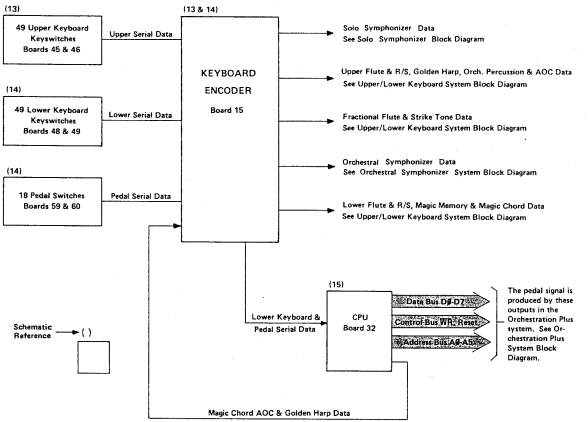
LOWER KEYBOARD

The data for keying the lower keyboard voices and features is produced by the keyboard scanning system and the keyboard encoder. (See keyboard and pedal scanning system block diagram.) This positive data is routed to the lower keyboard decoders IC1 & IC2 (9-H4) where it is shifted into IC1 & IC2 by the scan clock at pin 2. At time point 67 the data is lined up at its correct position and a strobe pulse occurs causing the outputs where data appears to switch to a tri-state condition. When an output switches to a tri-state condition the 22K pull down resistor at the base of the PNP keyers Q2-Q50 (9-F4) causes the keyer to turn on, supplying voltage to the lower diode readout circuits (9-F4). This voltage also charges a 22 uf sustain capacitor, the discharge time of this capacitor is dependent on the position of the sustain lower tabswitch. The voltage applied to the readout circuits allows audio signal from the tone generators to pass forming the 2-, 4- & 8-foot lower diode keying groups. The lower diode keying groups are routed to the lower sustain flute filter board where each footage is filtered to produce the lower 2-, 4- & 8-foot flute voices. The output of each set of filters is routed to a preamp (8-F3, 5 & 10). The output of each flute preamp is routed to a flute switcher and to a Custom Preset Volume Control. Selecting a flute tabswitch allows this signal to pass to the Lower Keyboard Flute Preamp IC1C (8-B3). If the Custom Flute Preset tab is on, the flute tabswitch voltage is removed and Switcher Q52 (9-C1) is turned on allowing flute audio to pass through the Custom Preset Volume Controls to the lower keyboard flute preamp. The signal volume is controlled at the output of the Lower Keyboard Flute Preamp IC1C before being mixed with the upper flute signal by IC1D (8-A3). From this point the signal is channeled as described previously under the upper keyboard heading.

The 4- & 8-foot diode keying groups are also routed to the lower symphonic string filters (Dwg. 9) where the lower violina and viola voices are created. The lower symphonic string audio is routed through Lower Symphonic String Preamp IC2D (8-C2) to the Lower Symphonic String Volume Regulator IC4 (9-B2) where the signal volume is controlled by the lower Symphonic String Volume Control (9-C3) before being routed through Q50 to the output mixer. Here the lower symphonic string audio is routed into the 3-channel chorus modulator in the same manner as the upper symphonic string signal which was described previously under the upper keyboard heading. The lower symphonic string audio at the output of IC2D (9-C2) is routed to the output mixer (30-H4) where it is rectified and used to turn off the Squelch Switchers Q8, 9 & 10 (30-G10) allowing the chorus phase 1, 2 & 3 audio outputs to pass.

The lower R/S signal is created by combining the 4- & 8-foot diode keying groups through resistors at the input of the 8-foot Harmonic Mixer IC2A (8-G6). The diapason signal is created by combining the 4- & 8-foot diode keying groups through mixer transistors (8-H7). The output of each mixer is then routed to 1 of 7 diapason filters. The combined filter outputs are then routed to the diapason preamp IC1A (8-E8). The R/S audio output from IC2A (8-G6) and the diapason audio output from IC1A (8-E8) are then routed to the main QC board (7-F7 & H10). The R/S audio is routed through piano, banjo and guitar filters (7-D8) to the lower keyboard modulator where these voices are modulated at the speed of the rhythm. If more than one of these voices is selected, the voices applied to the modulator are controlled by the Genie Accent circuit (see Truth Table in Drawing 7 Waveforms). The output of the modulator is routed through Lower Keyboard Preamp IC3A (7-C8), and the Genie Volume Control to the R/S Mixing Preamp IC3C (7-B5). The diapason audio is routed through switcher Q21 (7-F10) to the R/S mixing preamp. Here the R/S and diapason audio combines with the upper R/S audio and is channeled to the output mixer as described previously under the upper keyboard heading. The Vox Humana audio is taken from the Vox Humana Preamp IC3B (7-A11) and routed directly to the 3-channel chorus input of the output mixer (30-H4) giving the Vox Humana voice a preset chorus effect.

KEYBOARD & PEDAL SCANNING SYSTEM


(13)
49 Upper Keyboard Keyswitches Boards 45 & 46
Upper Serial Data
(13 & 14)
KEYBOARD ENCODER Board 15
(14)
49 Lower Keyboard Keyswitches Boards 48 & 49
Lower Serial Data
(14)
18 Pedal Switches Boards 59 & 60
Pedal Serial Data
Solo Symphonizer Data
See Solo Symphonizer Block Diagram
Upper Flute & R/S, Golden Harp, Orch. Percussion & AOC Data
See Upper/Lower Keyboard System Block Diagram
Fractional Flute & Strike Tone Data
See Upper/Lower Keyboard System Block Diagram
Orchestral Symphonizer Data
See Orchestral Symphonizer System Block Diagram
Lower Flute & R/S, Magic Memory & Magic Chord Data
See Upper/Lower Keyboard System Block Diagram
(15)
CPU Board 32
Lower Keyboard & Pedal Serial Data
Data Bus D0-D7
Control Bus WR, Reset
Address Bus A0-A15
The pedal signal is produced by these outputs in the Orchestration Plus system. See Orchestration Plus System Block Diagram.
Schematic Reference ( )
Magic Chord AOC & Golden Harp Data

KEYBOARD & PEDAL SCANNING SYSTEM
[Schematic 13 & 14]

[Number-letter designation shown in parenthesis are schematic numbers and map coordinates where component is located.]

The scanning for upper, lower keyboard and pedals is done with parallel/serial shift registers. The timing and clock signals for the scan are controlled by the microprocessor through the SIC II IC25 (15-G7). The clock and timing signals are not shown in the block diagram above. A BOS (begin of scan) pulse strobes the parallel/serial shift registers loading the registers with any keydown information. The scan clock shifts this data through the registers creating 3 serial data streams: one for upper keyboard, one for lower keyboard and one for pedals. The BOS pulse occurs at time point 1 for upper keyboard, time point 8 for lower keyboard and time point 67 for the pedals. The lower keyboard scan starts 8 time points later to align upper and lower keys to scan at the same time point. For example, time point 8 for the upper scan would be Key F4, at this time the lower scan starts and the first key scanned is F5.

UPPER KEYBOARD SERIAL DATA

The upper keyboard serial data is processed in different ways and is used to key the upper keyboard Flute and R/S voices, the Orchestral Percussion voices and the Orchestral, Custom and Solo Symphonizer voices.

SOLO SYMPHONIZER DATA

The upper keyboard raw serial data is routed onto the keyboard encoder board through a 1K isolation resistor (13-A6), where it is then routed to the PNG (Priority Note Generator) (26-E6).

The PNG decodes the data into an audio frequency which is used to create the voices of the solo symphonizer and the solo voice of the custom symphonizer.

ORCHESTRAL SYMPHONIZER DATA

The upper keyboard raw serial data used for the Orchestral Symphonizer is routed through IC31 (14-C8) to a 12-bit delay which causes the data to line up at a 16-foot pitch in the Orchestral Symphonizer Decoders (22-H2). The highest note of the Orchestral Symphonizer Data also generates an octave code pulse at the collector of Q11 (14-D12). This pulse generates an octave code out of the PNG (26-C6) which causes the tuning of the Orchestral Symphonizer Voltage Controlled Filter to follow the highest keyboard note being played. This feature is only used for the Orchestral Symphonizer when the Orchestral and Filter Follow pushbuttons of the Custom Symphonizer section are on. The Orchestral Symphonizer Data is used to key all voices of the Orchestral Symphonizer, the Wow and Orchestral voices of the Custom Symphonizer.

UPPER KEYBOARD FLUTE AND R/S DATA

The upper keyboard data used to key the flute voices (except fractional flute voices) and R/S voices is routed through pin 13 of IC30 (13-C11) to the upper keyboard Decoder circuits. For the fractional flute voices this data is routed through pin 2 of IC27 (14-B8) to the fractional flute and strike tone decoders (Dwg. 5).

ORCHESTRAL PERCUSSION DATA

Except for the chimes and bells voices, all voices in the Orchestral Percussion section are keyed by the Upper Keyboard Decoders (3-B9). The audio signal for these voices is routed to the Percussion and Slow Attack Modulator IC1 (7-D4). The new keydown and any keydown signals from IC25 pin 15 (13-G4) and pin 12 (13-C2) are routed to the modulator drive circuits on the main DC control board (3-A11 and G9). These signals are used to produce the percussive or slow attack envelope that drives modulator IC1 (7-D4) and gives these voices their percussive or slow attack character.

Turning on the bells or chimes voice allows the output of the Percussion Data Collector IC36B (13-G10) to pass to the upper keyboard decoder circuits (3-A7). A new keydown pulse is developed by comparing keydown data from the current scan to keydown data of the previous scan. The previous scan data is stored in IC17 (13-D6). The new scan data and the inverse of the previous scan data are ANDed together by IC15A (13-D7) which only allows a data pulse through for a key that was not down on the previous scan. If keyswitch bounce occurs, a negative pulse is generated at the output of IC13B (13-F7). This pulse circulates through IC18 (13-E9) and is applied to Pin 6 of IC15B (13-D10) for approximately 2 scans (10mS) and blocks any erroneous data from passing through IC15B. Data passing through IC15B is inserted into register IC38 (13-G6) where it circulates for approximately 2 scans. This circulating data is routed through IC36B (13-G10) to the decoder circuits (3-A7) where the audio signal is keyed. After the circulating enable time constant at pin 6 of IC26 (13-G5) is satisfied, the data is no longer output and the keyer circuits at the output of the decoders decay (3-C9) giving these voices their percussive character. (It should be noted here that the percussive effect of the chimes and bells is produced by circulating the data in register IC38 (13-G6). The signal for these voices does not pass through modulator IC1 (7-D4) as the other orchestral percussive voices do. This creates a monophonic percussion for the chimes and bells voices, meaning that if additional keys are added only the new key played will percuss. This differs from the other Orchestral Percussion voices in that adding a new key with these voices will percuss the new key and any other keys that have already decayed and are still being held down. With the chimes on, the circulating data also loads shift registers IC39-IC41 (13-G8&9) with 3 additional data bits, these bits are loaded at pin 4 of IC41, pin 13 of IC40 and pin 13 of IC39. These bits are shifted through IC28A and IC36B (13-G1) to the decoder circuits (3-A7) where the 3 added data bits and the bit generated by keydown line up to key the four audio signals that comprise each chimes note.

STRIKE TONE DATA

The Bells and Vibes voices key a strike tone frequency at initial keydown. The new keydown data at pin 4 of IC15B (13-D10) is routed through pin 11 of IC27 (14-C4) to the Strike Tone Data Position

Register IC33 (14-C5). This data circulates around IC33 until time point 50, at that time a high level from the SIC IC25 (15-G7) is applied through Buffer IC2B (14-B3) to pin 8 of IC26 (14-B8). If Vibes or Bells are on, pin 10 of IC26 goes high enabling the strike tone data bit to pass through IC27 pin 12 (14-B9) to the strike tone decoders (5-H1). This data will line up at one of the strike tone keyer circuits (pins 9-20 on IC1) and key the appropriate strike tone frequency. The chart on Dwg. 5 shows what frequency is keyed for each keyboard note. All like notes key the same frequency. For example, all C's key a B8 octave frequency.

MARIMBA REPEAT

Turning on the Marimba Repeat tabswitch (13-F1) cancels the normal path for upper keyboard data by allowing positive voltage to reach pin 3 of IC35 (13-C10). This causes the output of IC35B to go low holding pin 12 of IC30 (13-C11) low, blocking the upper keyboard data on pin 13 of IC30 from passing. Also, with this tab on the output of Register IC21 (13-F3) is enabled along with the Data Select Flip-Flop IC20B (13-E5). Under this condition all upper keyboard data is routed simultaneously into pin 1 of register IC 21 and into pin 5 of IC19 (13-F4). Register IC21 duplicates the keydown data one octave lower. This data is added to the stream through IC19B. Depending on whether Flip-Flop IC20B (13-F5) has just been set or reset, the odd numbered or even numbered data pulses are allowed to pass through data enable IC22C (13-F5). For example, assume a three-note chord is being held on the upper keyboard producing 3 data bits. Register IC21 (13-F3) duplicates these 3 bits one octave lower and adds them to the serial data stream. Now there are six data pulses in the stream. Assuming Flip-Flop IC20B has just been reset, ($\overline{Q}$ high) the first data pulse through IC19B will pass through data enable IC22C. At the same time this data pulse clocks IC20 through IC35D causing the $\overline{Q}$ output of IC20 to go low. The next data pulse will not pass through IC22C. However, it does clock IC20 ($\overline{Q}$ high) which allows the third data pulse through. On the next transition of the Marimba Speed Flip-Flop IC23B (13-D5), IC20B will start out in a set condition which will allow the even numbered data pulses to pass. For each transition of the Marimba Speed Flip-Flop the data heard alternates between the odd numbered and even numbered data creating the marimba repeat effect.

Note: If the Upper Cancel Enable Input [13-C1] is low, the Marimba tabswitch will have no effect. A Truth Table [13-B9] is provided showing when this condition is present.

GOLDEN HARP DATA

The Golden Harp data is produced by the microprocessor IC1 (15-A2). Lower keyboard data at the emitter of Q1 (14-F7) is routed to the microprocessor through Serial Interface Controller (SIC) IC25 (15-G7). If the Golden Harp footswitch (located to the right on expression shoe) is pressed and a Golden Harp direction pushbutton is selected (up, down). The microprocessor will put out the first note of the Golden Harp sequence, based on the lower keyboard keydown data. The Golden Harp note is output through SIC IC25 pin 4 (15-G8) to the input of Buffers IC1F (14-A2) and IC2A (14-C2). The data through IC2A enters the strike tone register and is output to the Strike Tone Data Decoders (5-H1) if the Bells or Vibra Harp voices are being played with Golden Harp. The data through IC1F (14-A2) passes through IC26A (14-A4) to data Collector IC30 pin 1 (13-All) where it routed to the upper decoder circuits (3-A7) and keys the appropriate audio signal. The number of scans the microprocessor outputs each note in the sequence is determined by rhythm speed and harp speed pushbuttons. Only data from the first scan of each new note in the sequence is allowed to pass to the Strike Tone Data Position Register IC33 (14-C5). This prevents repetitive strike tones from occurring as the Golden Harp note decays. This is accomplished by the Golden Harp Strike Tone Data Latch IC29A&B (14-D2). The first time a Golden Harp data bit is present, it trips Flip-Flop IC29 and pin 4 goes low. This low is transferred to the output of IC25 (14-C3) and disables the Golden Harp input to IC27 (14-C4). Before the microprocessor outputs the next note in the Golden Harp sequence, there will be a pre-determined number of scans where no data appears. This will allow IC29 (14-C2) to reset, which enables IC27 to except data for the first scan that the new Golden Harp note appears. The length of the Golden Harp note is determined by the time constant at pin 2 of IC26 (14-A3) which discharges when the output of IC25A pin 2 (14-C3) goes low. Turning on the Orchestral button of the Golden Harp section causes the enable input (14-A1) to go low and at the same time, pin 6 of IC31 (14-D11) switches high and allows the Golden Harp data to pass to Orchestral Symphonizer Decoders (22-H2) giving the Golden Harp effect to all voices in the Orchestral Symphonizer section.

AOC DATA

The AOC data is produced by the microprocessor IC1 (15-A2) and is dependent on lower keyboard keydown information. The AOC data is input through Buffer IC1F (14-A2) to AND gate IC28D (14-B4) and enters the 12 bit recirculating register IC34 (14-B5). This data is actually lower keyboard keydown information without an octave relationship. Holding down one lower keyboard key will produce one data bit input to register IC34 (14-B5). If Magic Chord is on, the processor calculates the chord from the lower keyboard keydown data and inputs the chord data to register IC34 (14-B5). The output of IC34 for AOC is taken from pin 11 and routed to the input of IC37A (13-H10). Playing an upper keyboard key routes a data pulse through IC37C (13-G7) and loads registers IC39-IC41 with a specific bit pattern. With AOC Organ on, the bit pattern starting at pin 7 of IC39 is 00000000 00000111 11111100. With AOC Organ and AOC Open Harmony on, the bit pattern for the three registers is 00000001 11110111 11100000. These bit patterns are clocked through IC39-IC41 and applied to pin 8 of IC37 (14-H10) allowing the circulating data at pin 2 of IC37A to pass when the bit pattern is at a high level. The upper keyboard data bit acts as the load pulse for the registers. The octave of the AOC data will follow the octave of the upper keyboard note being played and the data coupled will always be below the upper keyboard (melody) note. The load pulse also causes a one time point delay, so with AOC Organ on three time points after the load pulse occurs a series of nine ones appear at pin 8 of IC37A (13-H10) allowing the circulating data to pass. The three time point delay blocks notes that are within 3 notes of the upper keyboard note being played. For example, if a C note is played on the upper keyboard, the AOC window would open to let AOC data pass from A down through C# (played on the lower keyboard). See AOC Window Generator Timing Diagram.

With Open Harmony and AOC Organ on, there is a 6 time point delay before data is allowed to pass. For example, if a C note is played on the upper keyboard, the AOC Open Harmony window would open to let AOC data pass from F# down through G (played on the lower keyboard). The C note an octave below the C note being played is blanked from the scan. See AOC Window Generator timing diagram. All AOC data is then routed through IC30 (13-H11) to the upper keyboard decoders where the appropriate audio signals are keyed. Turning on AOC Symphonic adds the AOC data to the Orchestral Symphonizer data stream allowing all voices of the Orchestral Symphonizer to have an AOC effect.

LOWER KEYBOARD DATA

The path for lower keyboard data when Magic Memory and Magic Chord are off is through pin 9 of data collector IC14 (14-G11) to the lower keyboard decoders (9-H4) and is used to key the Flute and R/S voices of the lower keyboard. Turning the Orchestral Lower pushbutton (in the Custom Symphonizer section) allows the lower keyboard data to pass to the Orchestral Symphonizer Decoders (22-H2) through pin 8 of IC31 (14-D11). This makes it possible to play the Orchestral Symphonizer voices from the lower keyboard. With Orchestral Lower on, pin 2 of IC31 (14-C8) goes low and disables upper keyboard data from reaching the Orchestral Symphonizer Decoders. Since there is no 12 bit delay in the lower keyboard data path as there is in the upper, the Orchestral Symphonizer voices will play at an 8-foot pitch when keyed from the lower keyboard.

MAGIC MEMORY DATA

Data for Magic Memory is routed through IC10D (14-G7) to the lower keyboard data collector IC14 (14-G11). If the Magic Memory tabswitch is on, this data passes to the lower keyboard decoders (9-H4) and keys the lower keyboard Flute and R/S voices. The data through IC10D (14-G7) is also routed into recirculating register IC8 (14-G8). Any keydown data produced by the scan is continually circulated through IC8 and through pin 12 of IC10 to the lower decoder circuits. This causes any keys pressed to continue to play after being released. This circuit will not recognize a key up and the data in Register IC8 is only updated if a new keydown is detected. This is accomplished as follows: Data from the previous scan is stored in IC16 (14-H3), the inverse of this data is clocked out and compared to data of the current scan by IC15C (14-H5). If a new keydown has occurred, a positive pulse is generated at the output of IC15C at the time point of the new keydown. This pulse is latched at the output of IC12E (14-H6). At time point 64 it is routed through IC10B to pin 10 of IC8. This blocks the circulation of data and clears register IC8. At the end of the next scan pin 1 of IC11A goes low and the new keydown data is allowed to enter IC8 at pin 15 where it will circulate until another new keydown is detected. If keyswitch bounce occurs, a

positive pulse is generated through IC3A and IC12F charging the capacitor at pin 4 of IC11. This holds IC11A in a reset mode until the time constant at pin 4 discharges. This blocks data from passing until the keyswitch contact stabilizes.

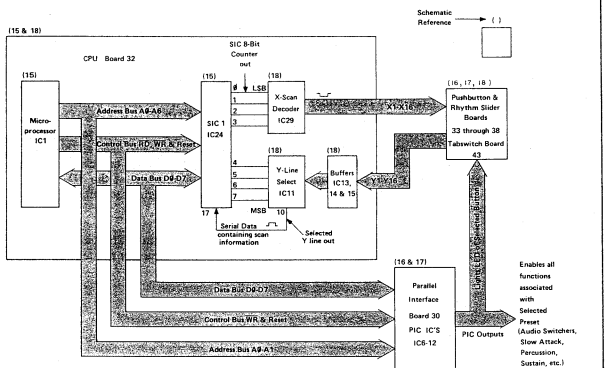
MAGIC CHORD DATA

Lower keydown data is routed through IC10A and Q1 (14-F7) to the SIC IC25 (15-G7). The microprocessor takes this data in from the SIC and calculates the chord that is to play. The chord data (AOC data) is then routed through the SIC to the input of Buffer IC1F (14-A2) and then enters the recirculating shift Register IC34 (14-B5) through gate IC28D and IC36C (14-B4). The keydown data from the scan is also routed through IC10C (14-F8) and triggers the Magic Chord Octave Position Flip-Flop IC9A&B. Pin 4 of the Flip-Flop goes low and pin 3 goes high and enables gate IC37B (14-F10). Since pin 4 of the Flip-Flop was previously high, there are 12 ones stored in shift register IC6. These 12 ones are shifted through register IC6 to pin 4 of IC37B generating a 12 bit window and allowing chord data from IC32A pin 2 (14-A6) to pass through IC37B. Since the note being played generates this window, the chord data will play in the octave of the played note. If the key is being played in the lowest octave, the chord window is generated at time point 37 through pin 8 of IC10C and the chord is automaticaly positioned in the lowest octave. Turning on the Magic Chord tabswitch allows this data to pass to the lower keyboard decoder circuits (9-H4) keying the lower keyboard voices.

PEDAL SERIAL DATA

The pedal serial data is routed through IC10A (14-F7) and Q1 to the SIC IC25 (15-G7). The microprocessor IC1 (15-A2) accesses this data to determine what pedal has been played. It then programs IC29 (19-B6) Programmable Oscillator on Orchestration Plus Board 25B. IC29 then outputs the appropriate 8-foot pedal signal at pin 21 (Freq. 4). This signal is routed to the pedal filtering circuits (12-C5) where the tonal quality for all pedal tabswitch voices is produced. The voices of the symphonic bass section (piano, bass fiddle and tuba) are produced by the voice 6 channel in Orchestration Plus circuit (21-E10) Board 25B. The pedals are inoperative if an Orchestration Plus style is being used.

PUSHBUTTON SCANNING SYSTEM



PUSHBUTTON SCANNING SYSTEM
[Schematics 15 & 18]

Scanning of the pushbuttons is controlled by Serial Interface Controller 1 (SIC) IC24 (15-G5). The SIC1 8 bit counter is output on pins 9-16. The 4 least significant bits (LSB) are routed to the X Scan Decoder IC29 (18-G2) and the 4 most significant bits (MSB) are routed to the Y Line Select Multiplexer IC11 (18-All). For each count of the counter, Decoder IC29 sequentially puts out a negative pulse on the X1 through X16 lines. After each sixteen counts of the counter the Y Line Select IC11 (18-All) is advanced, allowing the next Y Line to receive 16 X Scans. A switch closure will produce a negative data pulse at the input of the Y Line Selector. Each switch has a unique coordinate in the scan. For example, turning on the Ballad Rhythm button (18-D1) produces at negative pulse at pin 3 of IC11 (18-All) at coordinates X9-Y6. All data input to the Y Line Selector is inverted and multiplexed into a single serial data stream which is output at pin 10. The data is routed to SIC1 IC24 (15-G5) where it is stored. The microprocessor IC1 (15-B2) takes in this data from SIC1 and determines what switch or switches are active, then writes to the appropriate pin of a Parallel Interface Controller (PIC) IC on the parallel interface board, lighting the LED of the selected pushbutton (Schematic 16 & 17). Other PIC outputs may also be addressed, enabling audio switchers, sustain length, envelope generation or any other functions associated with the selected voice. For example, selecting the chimes voice (18-G11) produces a data bit at X4-Y2 time point. The microprocessor addresses PIC IC6 (16-A1) and switches pin 38 of this IC high lighting the chimes LED through inverter IC18 (16-B5). Pins 29 & 32 are also switched high, cancelling voltage to the upper tabs (4-G1) and enabling the chimes preset sustain (3-E7). In addition, pins 30 and 31 are switched low, cancelling all other upper keyboard voices (13-C1) and enabling the Chimes Data Generator IC39-IC41 (13-H2). Selecting any pushbutton causes a similar sequence of events to occur. The schematics have notes and truth tables identifying when a function is active. Active low inputs and outputs are identified with a bar over their function.

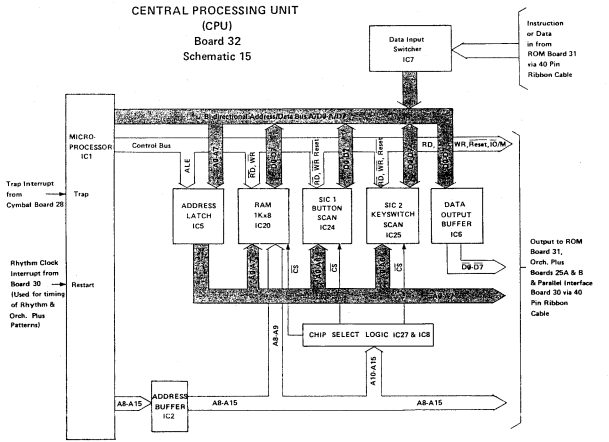
DIGITAL RHYTHM DISPLAY
[Schematics 17 & 18]

The 24 position Rhythm Slider switch (18-G7) is scanned as the pushbuttons are. The slider puts

out a binary code indicating the position of the slider. This information is routed to the SICI IC24 (15-G5) where it is stored. The microprocessor IC1 (15-B2) accesses this information and determines the values to be written to the Seven Segment Display Decoder Drivers IC36-38 (17-A3). The binary output from the microprocessor that is applied to IC36-38 causes the appropriate decoder outputs to go high, lighting the segments of the display that produce the decimal equivalent of the binary input.

From the position of the rhythm slider the microprocessor also determines the frequency of the Restart Interrupt on pin 7 (15-E2). The divider value to produce this frequency is written into the Clock 1 divider of the Programmible Oscillator Peripheral (POP) IC2 (17-B11) and the 4MHz clock input on pin 23 of IC2 is divided by this value. The clock 1 output on pin 19 is used to trigger the discharge circuit for the Orchestration Plus Glide circuit. This frequency is also used as the clock 2 input of the POP on pin 24 (17-C11). The ratio between clock 2 input on pin 24 and clock 2 output on pin 20 is always divided by 128, this ratio is established on initialization of the POP IC and remains constant. The clock 2 output on pin 20 is then routed to the microprocessor interrupt input and is used to time the Rhythm and Orchestration Plus outputs.

The only other output of IC2 (17-B11) that is used is the clock 4 output on pin 4. This clock output is programmed on initialization of IC2 to be a 33KHz frequency. This frequency remains constant and is used as the clock frequency for the Cymbal counters (29-E2).



CENTRAL PROCESSING UNIT
[Schematics 15 & 18]

The Central Processing unit of the MX1 consists of an Intel 8085 microprocessor, fifteen 4K x 8 bit ROMs (Read Only Memory), two SIC chips (Serial Interface Controllers), a 1K x 8 bit RAM (Random Access Memory), various tri-state buffers and an address latch.

THE 8085 MICROPROCESSOR

ADØ-AD7 (Pins 12-19)

These lines are a multiplexed address/data bus used for output of the lower 8 bits of memory address during the first clock cycle of each machine cycle. For the remaining machine states the bus becomes a bidirectional data bus. Since this is a multipurpose bus and address only appears for part of a machine cycle, an address latch chip IC5 (15-F4) is needed to hold the address for the entire machine cycle. This bus is tri-stated during hold and halt modes.

A8-A15 [Pins 21-28]

The 8 most significant bits of memory address are held on the line for the entire machine cycle and do not require an external latch IC. These outputs are tri-state during hold and halt modes.

IO/$\overline{M}$ [Pin 34]

The input output/$\overline{\text{memory}}$ indicates whether the microprocessor is accessing a memory device or an input output device. For example, if this line is low the microprocessor would be accessing a memory location in ROM, or RAM or one of the SIC chips. When this line is high, the microprocessor would be accessing an input output device such as one of the PIC chips on the Parallel Interface Board (Schematic 16 & 17) or the Orchestration Plus Boards (Schematics 19-21). This output is tri-state during hold and halt modes.

ALE [Pin 30]
Address Latch Enable goes high at the beginning of each machine cycle and latches the lower 8 bits of address ADØ-A7 into the Address Latch Chip IC5 (15-F4). The ALE line is never tri-stated.

$\overline{\text{INTA}}$ [Pin 11]
Interrupt Acknowledge, if an interrupt request is issued on the INTR input pin 10, pin 11 goes low to indicate the interrupt has been accepted. Not used in the MX1 system.

$\overline{\text{READ}}$ [Pin 32]
The Read Line is lowered when data from a selected memory device is being input to the microprocessor. The lowering of this line indicates that the Data Bus DØ-D7 is available for a data transfer. This output is tristate during hold and halt modes.

$\overline{\text{WRITE}}$ [Pin 31]
The Write line is lowered when data from the microprocessor is being output to a selected memory device. The lowering of this line indicates that the Data Bus DØ-D7 is available for a data transfer. This output is tristate during hold and halt modes.

RESET OUT [Pin 3]
This output goes high whenever $\overline{\text{Reset}}$ IN, pin 36 goes low. It is used to reset all other chips in the system.

CLOCK [Pin 37]
The clock output is used as the system clock. It is one half the crystal frequency or 3MHz.

$\overline{\text{RESET}}$ [Pin 36]
This input is held low during power on and resets the microprocessor program counter to zero.

READY [Pin 35]
If this input line is low it adds wait states to the machine cycle making it compatible with slower peripheral devices. Not used in the MX1 system.

HOLD [Pin 39]
If this input line is high the microprocessor tristates the Address, Data, Read, Write and IO/$\overline{\text{M}}$ lines and relinquishes control to the requesting device. Not used in the MX1 system.

HLDA [Pin 38]
The Hold Acknowledge output goes high to indicate that the microprocessor has received a hold request on pin 39 and that it will relinquish control of the busses on the next clock cycle. Not used in the MX1 system.

SERIAL INPUT DATA [Pin 5]
This input is under software control. Data on this line is loaded into bit 7 of the microprocessor's accumulator register whenever a specific instruction is being executed. This input not used in the MX1 system.

SERIAL OUTPUT DATA [Pin 4]
This output is under software control. Data in bit 7 of the microprocessor's accumulator register is output on this line whenever a specific instruction is being executed. This output not used in the MX1 system.

SO, SI [Pins 29 and 33]
These two outputs give an encoded status of the machine cycle that is being performed.

S1	S0	
0	0	Halt
0	1	Write
1	0	Read
1	1	Fetch

These outputs not used in the MX1 system, but status information is still available on these lines.

INTERRUPTS

The 8085 microprocessor is equipped with five interrupt lines. Two of these lines are used in the MX1 system. The TRAP interrupt on pin 6, and the priority 2 Restart interrupt on pin 7. The TRAP interrupt has the highest priority and is used to signal the microprocessor that the cymbal comparator (29-F3) value needs to be updated. When the TRAP interrupt input goes high, the microprocessor finishes the current instruction it is executing and then is vectored to a routine to service the cymbal circuit. After completion of this routine, the microprocessor refers to the position in program before interrupt occurred and continues executing instructions from there. The priority 2 Restart interrupt on pin 7 is used to time Rhythm and Orchestration Plus outputs. The frequency of this interrupt varies with the position of the Rhythm Speed Control. The microprocessor keeps track of the number of interrupts that have occurred and determines when a Rhythm or Orchestration Plus output is required. If an output is required, the microprocessor vectors to a routine to service the Rhythm or Orchestration Plus circuits. The priority of an interrupt indicates in which order the microprocessor will recognize and service interrupts.

ROM [Read Only Memory] IC1-IC15

The 15 - 4K x 8 bit ROMs serve as a place to store the instructions that direct the activities of the microprocessor. The group of instructions stored in ROM is referred to as a program. The microprocessor "reads" each instruction from memory in a logically pre-determined sequence. and initiates processing actions. ROM is also used to store the data to be manipulated as well as the instructions that direct the manipulation. The program is organized so that the microprocessor does not read a non-instruction word when it expects to see an instruction. The four most significant bits of Address A12-A15 are routed to a ROM Select Decoder IC17 (15-C8) which enables one of the 15 ROMs. The AØ-All address lines select a location in the enabled ROM. The microprocessor outputs this address and then issues a read pulse enabling input Switcher Buffers IC19 (15-B10) and IC7 (15-B7). The data or instruction from the selected ROM location is then input via the data bus into the microprocessor for processing.

RAM [Random Access or Read/Write Memory] IC20

The microprocessor uses the 1K x 8 bit RAM to store data that it can retrieve for use at a later time. For example, assume the microprocessor has a value in its Accumulator Registers that it wishes to save. The following sequence of events will store this value in a RAM location.

1. The contents of the program counter appears on the AØ-A15 address lines, an ALE pulse is generated latching the AØ-A7 address bits. The IO/M and the Read Line are lowered indicating a Memory Access cycle. The selected ROM location returns the addressed byte; in this case it would be the Store Accumulator Instruction.

2. The microprocessor decodes this instruction and then outputs the RAM address on the AØ-A15 address lines. The A8-A15 address lines are used to enable the chip select input of RAM through IC8 (15-D5). The AØ-A7 address lines are latched by ALE and address the specific RAM location where the data is to be stored.

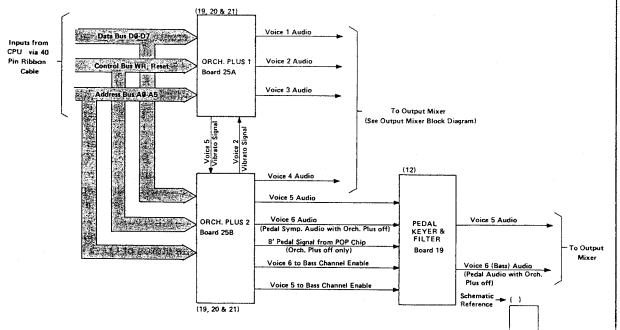
3. The microprocessor now outputs the contents of the Accumulator register on the DØ-D7 Data Bus, and generates a Write pulse. This latches the Accumulator value into the addressed RAM location.

   If this value needs to be accessed at some later time, a similar sequence of events occurs. The difference being that instead of a Store Accumulator Instrucion, the microprocessor would read a Load Accumulator Instruction and would generate a Read from RAM.

SIC [Serial Interface Controller] IC24 and IC25

The SIC ICs control the pushbutton and keyboard scanning systems. Data pertaining to active pushbuttons is input to IC24 and active key data is input to IC25. The microprocessor polls these two chips each cycle through the program loop. If data has changed from one scan to the next, the internal status register of the SIC chip indicates a change has occurred. The microprocessor then searches the SIC's internal RAM to "see" what data has changed. The new data is then processed to update pushbuttons and chord selections. IC25 is programmed by the microprocessor to output a 25KHz clock (used as the scan clock) and various strobes and timing pulses used by the keyboard encoder circuit. Chord and AOC data, which is calculated by the microprocessor from data obtained in scan, is output from the microprocessor through SIC chip IC25 where it is serialized and routed to the keyboard encoder circuit.

ORCHESTRATION PLUS & PEDAL SYSTEM
(Affects Orchestration Plus & Performance Effect Pushbutton Sections
and all
Pedal Tabswitch & Pedal Symphonizer Voices.)


(19, 20 & 21)
Inputs from CPU via 40 Pin Ribbon Cable
Data Bus D0-D7
Control Bus WR, Reset
Address Bus A0-A5
ORCH. PLUS 1 Board 25A
Voice 1 Audio
Voice 2 Audio
Voice 3 Audio
To Output Mixer (See Output Mixer Block Diagram)
Voice 5 Voices Signal
Voice 2 Voices Signal
Voice 4 Audio
Voice 5 Audio
ORCH. PLUS 2 Board 25B
Voice 6 Audio (Pedal Symp. Audio with Orch. Plus off)
8' Pedal Signal from POP Chip (Orch. Plus off only)
Voice 6 to Bass Channel Enable
Voice 5 to Bass Channel Enable
(19, 20 & 21)
(12)
PEDAL KEYER & FILTER Board 19
Voice 5 Audio
Voice 6 (Bass) Audio (Pedal Audio with Orch. Plus off)
To Output Mixer
Schematic Reference
( )

ORCHESTRATION PLUS & PEDAL SYSTEM
[Schematics 12, 19, 20 & 21]

There are six voice channels that produce the Orchestration Plus styles, three channels on each of the two Orchestration Plus boards. The schematics on Dwg. 19, 20 & 21 show the circuitry contained on one of the two boards. The voice channels shown in parenthesis indicate the equivalent channel on the second Orch. Plus board. Any differences between the two boards, such as input and output designations, are noted on the schematics.

ORCHESTRATION PLUS TONE GENERATOR

There are three 2MHz oscillators on each of the two Orch. Plus Boards Q20-22 (19-D5) which create the audio frequency source for the six Orchestration Plus voice channels. To produce the correct frequency for each of the channels, the microprocessor writes divider values into the five programmable dividers of the Programmable Oscillator Peripheral IC29 (19-A6). The 2MHz inputs are divided by these values and a square wave audio signal is produced on Pins 21, 4 and 5 of IC29. The microprocessor determines the divider values from information obtained in the scan. It then selects one of the Orch. Plus boards by enabling IC4 (19-E1). The A2-A5 address inputs to IC4 select the IC on that board which the microprocessor wishes to access. If IC29 (19-A6) was the selected IC, Pin 10 of IC4 would switch low. This low level is applied to Pin 2 of IC46A (19-A4). A $\overline{\text{write}}$ pulse occurring at this time would cause Pin 18 of IC29 to go low and the value on the DØ-D7 lines to IC29 would be latched into a selected divider. The microprocessor also programs the frequency of the outputs on Pin 19 & 20 of IC29 in the same manner. These outputs are routed to the filter circuit where they tune the filters to a specific frequency range.

Two voice channels on each board can have a vibrato effect. If vibrato is called for in the Orch. Plus style the microprocessor selects IC20 (19-D2) and writes Pin 13 (19-E2) of this IC high. This turns on Vibrato Enable Switchers IC5C&D (15-G3) and allows the output of the Vibrato Oscillator to vary the frequency of 2MHz oscillators Q20 & 21 giving these channels a vibrato effect. It should be noted that the output of the Vibrato Oscillator on each of the Orch. Plus boards drives one voice channel on each board. For example the vibrato oscillator on board 25A drives the 2MHz

oscillator for Voice Channel 1 on board 25A and Voice 5 on board 25B. This is noted on the schematic by the designation "other Orch. Plus Board" at S4-4 (19-G3) and S4-5 (19-H3) there is no schematic reference given for this input or output since the schematic shown is for both Orch. Plus boards.

Each of the Orch. Plus voice channels is capable of having a glide effect. The glide effect is produced by charging, then discharging, the 5.6 uf capacitor in the base circuit of each oscillator, momentarily shifting the oscillator frequency. The rate at which this cycle occurs is varied by changing the charge and discharge times of the 5.6 uf capacitor. To create the glide effect, the microprocessor enables IC20 (19-D2) and then writes a value into IC20 that will turn on some combination of Q23 & Q24 (19-B3). This sets the collector voltage of Q14 and controls the charging current available through Q14, thereby controlling the rate at which the 5.6 uf capacitor will charge. Once this collector voltage is selected, Q14 is turned on by applying a positive voltage to its base. This turns Q14 on applying a positive voltage to the emitters of Q11, 12 & 13 (19-3C, D & E). Depending on the channel or channels to be glided, one or more of these transistors is turned on, allowing the 5.6 uf capacitor to charge. As this capacitor charges it shifts the master oscillator frequency. Once the frequency has shifted the required amount, the Enable Switcher (Q11, 12 or 13) turns off allowing the capacitor to discharge onto the Glide Discharge line which returns the master oscillator to its normal operating frequency. The discharge rate of the capacitor is controlled by Q7, 8, 9, 10 & IC3. IC3 (19-F1) is a one shot multivibrator that is triggered at Pin 5 by a frequency which is variable with the Rhythm Speed. Each time IC3 is triggered, a positive pulse appears at its output, Pin 6. The pulse produced at Pin 6 is a waveform that is the frequency of the trigger input at Pin 5 with a duty cycle that is variable depending on the states of Q7 & Q8. If the positive cycle of this frequency is long in comparison to the negative cycle then Q9 & Q10 (19-F2) will be on for most of the cycle which reverse biases diodes D61, 62 & 63 and prevents the 5.6 uf capacitor from discharging during this period, thereby creating a long discharge time. Therefore, the discharge time can be altered by changing the duty cycle or the frequency of the IC3 output.

The glide rate, frequency shift and timing are all predetermined in the systems program and are dependent on the Orch. Plus style and chord being played.

ORCHESTRATION PLUS KEYER

There are three identical keyer circuits on each of the Orchestration Plus boards. One keyer is shown on Dwg. 19, the other two are shown on Dwg. 20. For description purposes, the references for the keyer circuit on Dwg. 19 are used.

The keyer circuits produce and select the audio signal waveform as well as producing the keying envelope. The square wave audio output of IC29 pin 21 (19-B6) is routed to Pin 13 of IC38 (19-C9). If the instrument being played in this channel calls for a square wave audio signal, Pin 11 of IC38 is switched high and Pin 11 of IC30 (19-C10) switches low allowing the square wave audio to pass to the base of Q39. The square wave audio signal is also used to trigger Flip-Flop IC18 (19-B9). IC18, 26, 43 and 44 comprise a variable pulse width generator circuit, capable of producing pulse audio waveforms with duty cycles ranging from 3% to 33%. The microprocessor, through IC42 (19-E7) applies a binary code to IC44 (19-B8) which selects one of the resistors at IC44's input. This causes the output of IC26A Pin 1 (19-A9) to rise to a positive level which is dependent on the resistor ratio chosen. The .33 at capacitor at Pin 5 of comparator IC43B (19-A10) charges to this level. When IC18A Pin 1 (19-C9) is triggered, its output Pin 3 goes high and charges the .33 uf capacitor at Pin 6 of IC43B (19-A9). When the charge on this capacitor is equal to the charge on the capacitor at Pin 5 of IC43B the output of IC43B goes low. This low is transferred through IC43A and resets IC18. As can be seen from the above description, Pin 3 of IC18 will remain high until the inputs of IC43B are equal, by simply changing the reference voltage on Pin 5 of IC43 (by selecting different resistor values through IC44) we can control the length of time that the output of IC18 remains high thereby controlling the duty cycle of the pulse wave audio signal output at Pin 3 of IC18. If the pulse wave audio signal is called for, Pin 11 of IC38 and IC30 (19-C9) is switched low allowing the audio signal to pass to the base of Q39. The pulse wave audio is also applied to the base of Q37 (19-C9). Q37 & Q38 transform the pulse wave audio signal into a sawtooth audio signal. If the voice playing calls for a sawtooth waveform, Pin 11 of IC30 is switched high allowing this audio signal to pass to the base of Q39. The chosen audio signal is then routed through the Audio Attenuator circuit where it is amplitude adjusted before being routed to the filtering circuits.

KEYING ENVELOPE GENERATOR [Dwg. 19]

The shape of the keying envelope is controlled by the combination of attack, decay and percussive snub resistors that is selected for a given voice.

When an orchestration plus note is to be played, the attack enable output of IC8 (Dwg. 21) switches high, applying +15VDC through the selected attack resistor to the base of the keying envelope generator. The attack time is the resistor-capacitor (RC) time constant formed by the selected resistor and the 1 uf capacitor at the base of the keying envelope generator. As the capacitor charges, Q33 (19-E9) turns on applying a positive going voltage to the audio modulator driver (Dwg. 21), the modulation range selector (Dwg. 21) and the decay start detector (19-E10). When the emitter of the keying envelope generator exceeds +12VDC the output of the decay start detector switches low. The microprocessor checks the status of the six decay start detectors (15-B11). When a decay is to begin, the microprocessor turns off the attack enable and switches the decay or percussive snub enables low, providing a discharge path for the 1 uf capacitor.

ORCHESTRATION PLUS FILTERS [Dwg. 21]

The audio waveform is amplified by the filter input preamp (21-E3) and applied to the first voltage controlled filter. The voltage controlled filters are tuned by the width of the pulses applied to the gate inputs of the switchers. The switchers act like variable resistors. The "resistor"-capacitor (RC) combination determines the resonant frequency of the filter. As the effective value of the "resistor" changes, the tuning of the filter changes. The pulse width and pulse frequency are selected by the microprocessor and are determined by the voice and frequency to be played. The pulse width is modulated by the filter envelope (from keying envelope generator). Voice 1 and Voice 4 each have a filter which can be switched into the circuit to create the banjo voice.

The output of each filter is applied to an audio modulator which is controlled by the keying envelope. The signal output for Voices 1 through 4 are applied to the output mixer. Voices 5 and 6 are routed to the Pedal Keyer and Filter Board where either Voice 5 or Voice 6 is switched into the Bass Mixing Preamp.

BASS QUALITY CONTROL [Dwg. 12]

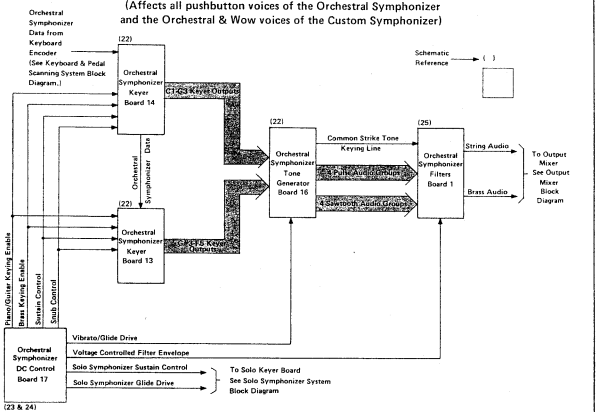
When Orchestration Plus is off, Voice 4 (IC29 Pin 21, Board 25B) (19-C6) provides the audio frequency for the bass pedals and keyboard bass. The signal is applied to the pedal audio buffer (12-C5) and the pedal frequency divider (12-D5). When a bass note is keyed, the rhythm PIC (Dwg. 28) applies a positive keying voltage to the Pedal Keydown Driver Q3 (12-B3). If a bass tab is on, Q3 turns on applying positive voltage to keyer drivers Q7 (12-B4), Q15 (12-F4), Q4 (12-G4) and Q11 (12-D6). The voltage applied to Q4 is developed into a pulse for the guitar bass. The envelope output from each keyer driver forward biases a keying diode enabling audio signal to be applied to a filter where it is voiced. A switcher at the output of each filter enables the bass audio to pass to the Bass Mixing Preamp IC4D (12-C11). The double bass (pedal string) audio is applied to the three channel chorus modulator via the mixer. (See Dwg. 30.)

The Symphonic Bass Piano, Bass Fiddle and Tuba presets are developed by Voice 6 of the Orchestration Plus. This signal is routed through Q2 Voice 6 to Bass Switcher (12-B10) to the Bass Mixing Preamp IC4 (12-C11).

When the Orchestration Plus is being played, the pedal keydown voltage is grounded through Q30 (12-B2). The bass audio is developed by Voice 6. Voice 5 is used for some Orch. Plus patterns. (See Orchestration Plus Chart.) The voice with the bass audio is routed to the Bass Mixing Preamp. The other voice is routed to the output mixer (Dwg. 30) after being amplified by Orch. Plus Voice 5 Preamp (12-A11).

The signal output from the Bass Mixing Preamp is attenuated by the Bass Volume Switchers then applied to IC4A Bass Preamp. The output of the bass preamp is applied to the mixer. (See Dwg. 30.)

ORCHESTRAL SYMPHONIZER SYSTEM
(Affects all pushbutton voices of the Orchestral Symphonizer and the Orchestral & Wow voices of the Custom Symphonizer)



ORCHESTRAL SYMPHONIZER SYSTEM

ORCH. SYMP. KEYING [Schematic 22]

Upper keyboard serial data (Lower keyboard data when Orch. to Lower coupler is on) is shifted serially into Serial to Parallel Decoder Latches IC1 (Board 14) and IC1 (Board 13). When data has shifted into the latches and is properly aligned, a strobe pulse occurs latching the data. Had keys been pressed, the corresponding outputs of the Decoder Latch would switch high. The logic level converters increase this voltage (depending on the orchestral symphonizer preset selected) and apply it to the Orch. Symp. Keyer Driver (22-E6). The input to the keyer driver may be either a pulse (piano/guitar) or a steady voltage (brass) depending on the preset selected. The keyer voltage is applied to the Pulse Keyer and Sawtooth Keyer (22-B8).

ORCH. SYMP. TONE GENERATOR [Schematic 22]

The Orch. Symp. Master Oscillator Q63 (22-F9) applies four megahertz to a divider. The two megahertz output of the divider is applied to a top octave synthesizer which generates an octave of audio frequencies. Each TOS frequency is applied to a divider to create the lower frequencies required by the Orchestral Symphonizer.

The outputs of the dividers are applied to the sawtooth and pulse keyers. When an Orch. Symp. note is keyed, the audio signal passes via the pulse keyer groups and sawtooth keyer groups to the Pulse Keyer Filters (25-H1) and Sawtooth Filters (25-D1).

ORCH. SYMP. QUALITY CONTROL [Schematic 25]

The pulse keyer filters and sawtooth filters provide waveshaping before the audio is applied to the specific voicing filters. Each voicing filter develops the tonality for the specific voice. The switcher for the voice to be heard is enabled by a positive voltage applied to the gate input of the FET.

The string voices (except banjo) and the French Horn are phase modulated by the chorus modulator. The phase modulated audio is applied to the String and Brass Volume Regulators. The outputs of the volume regulators are routed to the Output Mixer.

The Voltage Controlled Filter (25-B2) has a voltage envelope applied to it. As the voltage changes, the harmonic content of the audio signal changes creating the tonality of the selected voice.

ORCH. SYMP. DC CONTROL [Schematic 23]

The Tremolo/Vibrato Oscillator provides a low frequency signal to modulate the orch. symp. keying voltage (tremolo) and the Orch. Symp. Master Oscillator (vibrato) 22-G9. At the first keydown the delay trigger 23-A2 momentarily disables the tremolo/vibrato oscillator.

The Orch. Symp. Driver Q14 (23-B11) applies positive voltage to the Logic Level Converters (Dwg. 22). Some of the presets use a low keying voltage which is enabled by turning on Q13 (23-B10).

The switching control for the transistors is provided by Parallel Interface Controllers (PIC). The selected orchestral preset determines which of the switchers is enabled or disabled for glide, sustain length, tremolo, repeat and guitar snub. The enables for solo glide and sustain are located on this board.

ORCH. SYMP. FILTER ENVELOPE [Schematic 24]

The circuitry shown on Schematic 24 provides an envelope which is used to control a voltage controlled filter (25-B2) for the Orch. Trumpet, Wow, Brass Ensemble, and Orchestral Custom presets.

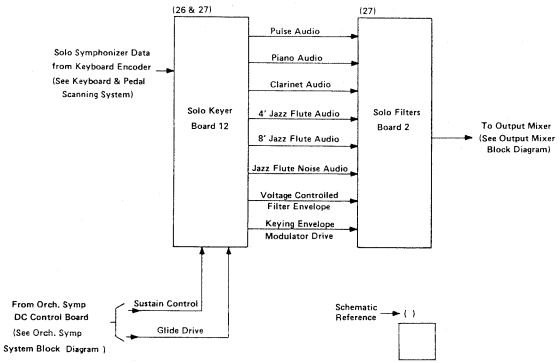
When either the trumpet, brass ensemble, wow or custom preset is selected, the appropriate set of attack, range, tuning, decay and sustain switchers is selected. The brass keying line is selected.

Any keydown will cause the Filter Envelope Trigger (24-D2) to output a pulse. This pulse resets the Set-Reset Flip-Flop(24-E4), discharges the .68 uf capacitor at the base of Q6 (24-D5) and turns off Envelope Generator Q5 (24-D5). At the conclusion of the trigger pulse, Q5 turns on causing the .68 uf capacitor to charge at a rate determined by the selected attack resistor. The positive going ramp is applied through a range resistor to the Initial Frequency Preamp (24-C7). The signal gain (less than one) is determined by the range resistor. The filter tuning preamp (24-D8) further amplifies the signal. The signal is attenuated through the octave select decoder (24-E10). [See chart on Schematic 24 to see which resistor is selected in any octave.] and applied through a voltage follower and the filter tuning driver to the Voltage Controlled Filter (25-B2).

The maximum level output from Q6 is determined by the voltage divider at pin 6 of Comparator IC9B (24-F5). When the level at pin 5 exceeds the reference level, the output of the comparator (pin 7) switches high, which sets pin 4 of IC7B (24-F4) high. The decay envelope switcher turns on and the .68 uf capacitor begins to discharge at a rate determined by the decay resistor and sustain resistor.

SOLO SYMPHONIZER SYSTEM

(Affects all Solo Symphonizer Voices &
Solo Voice of the Custom Symphonizer.)



SOLO SYMPHONIZER SYSTEM

TONE GENERATION [Dwg. 26]

The Solo Symphonizer employs a Solo Note Generator to develop the audio frequencies, keydown voltage and octave selection data. The solo master oscillator (26-B5) applies four megahertz to a divider. The one megahertz output is applied to the solo note generator where internal circuitry divides the frequency to provide the audio output. The solo master oscillator frequency is modulated by the Solo Vibrato/Tremolo Oscillator (26-A3) giving a vibrato effect when the tremolo depth is increased.

The keyboard encoder (Dwgs. 13 and 14) provides the clock, strobe and upper keyboard data to the solo note generator. The solo note generator outputs only the highest note being played on the upper keyboard at 4-, 8- and 16-foot pitches. The 4- and 8-foot audio is used for the jazz flute preset. The 16-foot pitch is used for all other presets.

SOLO KEYING [Dwg. 26]

Pin 15 of IC30 (Solo Note Generator) switches high when a key is pressed. This applies keying voltage through the keyer delay to the drivers used to key the solo presets.

The keying voltage is developed into a pulse for use by the Percussion Driver. The decay length of the pulse is determined by the snub circuit that is selected.

The keying input to Pulse Driver IC29A (26-B12) is either the percussion envelope or the slow attack envelope. The output pulse width is determined by the amplitude of the percussion or slow attack pulse.

SOLO FILTER [Dwg. 27]

When a solo preset is selected, the keyed audio signal is routed to the selected filter to develop the tonality of the instrument. The voiced audio is applied to the Solo Audio Preamp IC25B (27-D12)

where the signal is amplified. The output of the preamp is applied via the Solo Volume Control to the Mixer.

The Filter Envelope Generator circuit shown on Schematic 27 provides an envelope which is used to control a voltage controlled filter (27-B11) for the Solo Trumpet, Trombone, Jazz Guitar and Solo Custom presets.

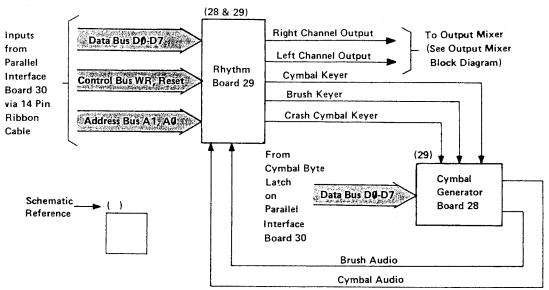
When either the trumpet, trombone, jazz guitar or custom preset is selected, the appropriate set of attack, range, tuning, decay and sustain switchers is selected. The pulse audio line is selected.

Any keydown will cause the Filter Envelope Trigger (27-D2) to output a pulse. This pulse resets the Set-Reset Flip-Flop (27-E3), discharges the .82 uf capacitor at pin 12 of Voltage Follower IC23 and turns off Envelope Generator Q22 (27-D4). At the conclusion of the trigger pulse, Q22 turns on causing the .82 uf capacitor to charge at a rate determined by the selected attack resistor. The positive going ramp is applied through a range resistor to the Initial Frequency Preamp (27-D5). The signal gain (less than one) is determined by the range resistor. The filter tuning preamp (27-D6) further amplifies the signal. The signal is attenuated through the pulse code filter and applied through the filter tuning driver to the Voltage Controlled Filter (27-B11).

The maximum level output from IC23B is determined by the voltage divider at pin 2 of Comparator IC23A (27-E4). When the level at pin 3 exceeds the reference level, the output of the comparator (Pin 1) switches high, which sets pin 4 of IC21B (27-E2) high. The decay envelope switcher turns on and the .82 uf capacitor begins to discharge at a rate determined by the decay resistors and sustain resistors.

RHYTHM SYSTEM

(Affects all Rhythm Patterns of the Stereo Digital Rhythm Button Section, also the Intro, Auto Start & Crash Cymbal Buttons of the Performance Effects Section.)



RHYTHM SYSTEM
[Schematics 28 & 29]

The position of the rhythm speed control (18-H7) is checked during the scan of the lighted button switches. The microprocessor determines the speed that the rhythm and orchestration plus is to play and programs a divider of Programmable Oscillator Peripheral (POP) IC2 (17-B11) to develop the proper rhythm clock frequency.

The rhythm clock is applied to an interrupt input of the microprocessor. When an orch. plus preset and/or rhythm is selected, the microprocessor counts rhythm clock pulses. When the processor determines that the orch. plus is to play or a rhythm beat is to be output, the processor extracts the data from tables located in read only memory (ROM) and writes this data to parallel interface controllers (PIC) located on the orch. plus and rhythm boards. (See Orchestration Plus System for information about the orch. plus.)

RHYTHM [Dwg. 28]

The outputs of the rhythm parallel interface controller (PIC) switch high (+15V) when selected. The Port 1 and Port 2 outputs of IC7 are applied through trigger circuits or capacitors to develop the outputs of the PIC into pulses which trigger the pulse generators into a ringing oscillation. This envelope creates the tonality of the rhythm instrument to be played. Port Ø controls sustain and snubs for several of the instruments.

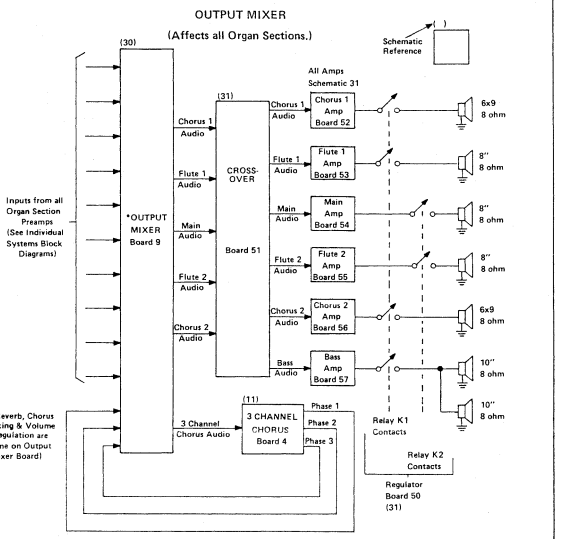
The signals are collected and amplified by the left and right channel collector preamps. The output of the collector preamps is applied to the left and right channel mixers where it is combined with brush and cymbal audio. Balancing is accomplished at the input to the mixers. The mixer outputs are applied through the rhythm volume control to the output mixer (Dwg. 30).

BRUSH/CYMBAL GENERATOR [Dwg. 29]

Read only memory (ROM) IC7 is a digital recording of a cymbal. The up/down counters address each ROM location at a rate of 33KHz from the cymbal clock. The output of the ROM is applied to a digital to analog converter which converts each byte of data into a DC voltage level. The DC level changes at such a fast rate that the sound of a cymbal is reconstructed. This signal is applied to the Cymbal and Brush Modulators. When a keyer pulse is applied to a modulator, the cymbal audio

passes through the modulator to the preamps (Dwg. 28).

The microprocessor (Dwg. 15) writes a number to IC4 Cymbal Byte Latch (17-H11). Bits 0 to 6 of this number are applied from IC4 to the "B-inputs" of Comparators IC5 and IC6. Bit 7 is applied to the Upcount/Downcount Switcher IC4A (29-H3). When the seven most significant bits (MSB) of the up/down counters equal the number from the cymbal byte latch, a positive pulse is output from IC5 Pin 6. This pulse will change the direction of the counter if bit 7 is high and clocks the Trap Enable Latch IC4B (29-H4). The output of IC4B applies a high to the TRAP interrupt of the microprocessor. The microprocessor completes the instruction being executed then vectors to the cymbal servicing subroutine. A new byte is latched into the cymbal byte latch and the trap enable latch is reset. The microprocessor returns to the main program and resumes operation from the point it was interrupted. The changing count, determined by the cymbal byte creates the shimmering sound of the cymbal.



OUTPUT MIXER

OUTPUT MIXER [Dwg. 30]

All audio signals created by the organ are applied to the output mixer. The signals are distributed to the five volume regulators through resistors which balance the sound.

All audio signals (except the chorus modulated flute and chorus modulated reed/string audio) are applied to the reverb circuit. A limiter (30-A7) controls the signal amplitude to reduce distortion through the reverb. The output of the reverb amplifier is distributed to the five volume regulators.

The volume regulators are controlled by the expression pedal. As the organ volume is increased, a shutter located between the photocell and lamp (30-H10) opens allowing more light to reach the photocell. The resistance of the photocell decreases as light intensity increases applying more voltage to the volume regulator driver which applies more voltage to the volume regulators, increasing volume.

The output amplifiers provide current gain for the audio signal. The audio signal is then applied to the crossover filters.

CROSSOVER [Dwg. 31]

Signals applied to the crossover board are applied to the chorus, flute and main high pass filters and to the bass low pass filter. Frequencies below 200Hz pass through the bass low pass filter to the bass amplifier. The Bass Channel Volume Regulator IC1 (31-G10) is controlled by the Volume Regulator Driver (30-H1).

AMPLIFIERS [Dwg. 31]
The amplifiers provide signal and current gain to drive the speakers. The outputs of the amplifiers are mixed to two channels for the headphones and to provide the left and right channel auxilliary outputs.

THREE CHANNEL CHORUS [Dwg. 30]
The upper and lower keyboard strings are applied through the Chorus Audio Mixer IC7 (30-G6) to the three channel chorus board. The Orch. Plus, Orchestral, Main Reed/String, Solo and Flute are routed to the chorus audio mixer when the appropriate chorus switcher is enabled.

FLUTE/STRING CHORUS MODULATOR [Dwg. 11]
The Fast Clock (19.6Hz) and the Slow Clock (2.2Hz) frequencies are each divided by three to create three clock frequencies with 120 degrees of phase shift. The like phases of fast and slow clock are combined through filters to create a low frequency sine wave modulated by the fast clock. Each output is amplified through a driver and applied to a voltage controlled oscillator (VCO). As the voltage applied to the VCO varies, the frequency of the oscillator varies from approximately 220KHz to 385KHz.

Each VCO output is applied to a bucket brigade. The audio signal applied to the bucket brigade is shifted through it at the rate of the VCO clock. Because the VCO frequency varies, a phase shift is created. The low pass filter removes the VCO clock from the audio signal. The three phase modulated audio signals are returned to the output mixer (Dwg. 30).

CHORUS SQUELCH [Dwg. 30]
Normally, the output of Comparator IC6C (30-G8) is a positive voltage, keeping Buffer Q10 (30-G9) biased on. The buffer applies a positive voltage to the three Chorus Squelch Switchers (30-G10). These transistors are turned on, grounding any noise which may be generated by the chorus modulator.

When a key is pressed, the audio signal output from the Chorus Audio Mixer IC7A (30-G6) is applied to the bucket brigades (Dwg. 11) and to Squelch Amplifier IC6B (30-G6). The squelch amplifier output is applied to a full wave rectifier IC6A and IC6D which rectifies the audio signal into a positive DC voltage. This DC voltage is applied to comparator IC6C (30-G8). The output of the comparator switches negative, turning buffer Q10 off which turns off the chorus squelch switchers. The phase modulated audio is now applied to the volume regulators.

ADJUSTMENTS

All adjustments have been made at the factory. Normally, the only time an adjustment would be required in the field is when a repair has been made to the specific circuit where the adjustment is located.

1. **Unless specified, all tabs are off and controls at minimum.**
2. **Some adjustments are critical [the ones with factory-selected components]. Without the proper equipment, it may be better to leave the adjustment alone.**

SCHEMATIC 1
Board 20

MAIN OSCILLATOR TUNING PROCEDURE

1) Press and hold the upper keyboard C2 key for all steps of this procedure.
2) Press the 16-foot Trombone tab.
3) Using a tuning fork or other tuning device whose frequency corresponds to the key being held, adjust the tuning coil using a non-metalic tuning wand for a zero beat between the organ tone and the tuning device.
4) When this note is properly tuned, the TOS tuning is locked in.
5) Go to the Orchestral Symphonizer Tuning Procedure and begin with Step 2.

SCHEMATIC 2
Board 8

HAWAIIAN GUITAR/VIOLIN CHORUS OSCILLATOR MAXIMUM SPEED ADJUSTMENT

1) Connect oscilloscope to IC2 pin 6.
2) Turn Maximum Speed Adjustment VR1 until on cycle takes approximately 160mS.
3) This correctly adjusts the Chorus Oscillator for 6.3Hz.

BIAS ADJUSTMENT

To adjust the DC offset voltage:

1) Turn the Hawaiian Guitar preset on and the Percussion Volume Control to maximum.
2) Press the Magic Genie Chords tab and the AOC Organ tab.
3) Press a key on the lower keyboard and hold down a key on the upper keyboard.
4) Adjust the Bias Adjustment VR2 clockwise until the signal begins to distort.
5) Observe the position of the adjustment then turn VR2 counterclockwise until the signal begins to distort.
6) Adjust the potentiometer to the midpoint of the distortion regions.

SCHEMATIC 3
Board 18

VIBRATO SPEED ADJUSTMENT

1) Connect oscilloscope to the emitter of Vibrato Oscillator Q2.
2) Turn Vibrato Speed Adjust VR1 until one cycle of the Vibrato Oscillator is completed in approximately 160mS.
3) The vibrato speed is now adjusted to 6.3Hz.

VIBRATO DEPTH ADJUSTMENT

1) Connect oscilloscope to wiper of Vibrato Depth Adjust VR2 (S5-1).
2) Adjust VR2 for a 4 VPP indication on oscilloscope.

GLIDE ADJUSTMENT

1) Turn on an upper keyboard tab.
2) Press the C3 keyswitch.
3) Press the glide footswitch. The C3 frequency should detune one semitone (C pitch changes to B).
4) If adjustment is required, place a resistor substitution box, decade box or potentiometer in place of the factory-tailored resistor (if any at the anode side of D12).
5) Adjust value to obtain the one semitone shift in frequency when the glide switch is pressed.
6) Determine the value of the variable resistor then install a fixed resistor.
7) Re-check the glide.

SCHEMATIC 6
Board 10

SYMPHONIC STRING THUMP ADJUSTMENT

1) Place expression pedal at maximum expression (full volume).
2) Place Upper String Volume Control at maximum.
3) Press Symphonic Viola preset and Upper String Attack tab.
4) Repeatedly, press any key on the upper keyboard.
5) Adjust Symphonic String Thump Adjust for minimum keydown thump.

SCHEMATIC 7
Board 3

PERCUSSION THUMP ADJUSTMENT

The purpose of this adjustment is to minimize the DC transient (thump) which may occur when playing any of the repeat percussion voices (Harmonic 4', 2-2/3', Bells, Mandolin and Banjo). To adjust:

1) Place expression pedal at maximum expression and Percuss Volume Control to maximum.
2) Turn Repeat Speed Control to minimum.
3) Turn Repeat Percuss. tab on.
4) Turn Harmonic 4 preset on.
5) Adjust VR1 for minimum thump.

NOTE: If thump cannot be reduced satisfactorily by adjustment, then replace Modulator IC1.

GENIE THUMP ADJUSTMENT

The purpose of this adjustment is to minimize the DC transient (thump) which may occur when the lower keyboard Piano, Banjo or Guitar tabs are on and a rhythm is playing. To adjust:

1) Place expression pedal at maximum expression and Genie Volume Control to full volume.
2) Turn rhythm volume control to minimum.
3) Place rhythm balance control to extreme right of control movement.
4) Place Rhythm Speed Control to 380.
5) Select Metronome Rhythm.
5) Adjust VR2 for minimum thump.

NOTE: If thump cannot be reduced satisfactorily by adjustment, replace Modulator IC2.

SCHEMATIC 10
Board 5

PHASE 1, PHASE 2 BIAS ADJUSTMENT

To adjust the phase 1 or phase 2 bias:

1) Turn on the Flute Chorus and Chorus Celeste tabs.
2) Turn on the Flute 16 tab.
3) Play a note on the upper keyboard.
4) Turn bias adjustment clockwise until distortion occurs.
5) Observe position of the potentiometer then turn the adjustment counterclockwise until distortion occurs.
6) Proper setting is the midpoint of the distortion regions.

SCHEMATIC 19 & 20
Board 25A & 25B

OSCILLATOR TUNING PROCEDURE

1) Place organ in Orchestration Plus tuning mode as follows:
   a) Turn organ off.
   b) Place test switches (shown on Schematic 15, Board 31) off.
   c) Turn test switch one on.
   d) Turn test switch three on.
2) Turn organ on.
3) Orch. Plus Voice 1 produces an A pitch (440Hz).
4) On Board 24 (Upper Sustain Keyer), connect a jumper wire between the collector and the emitter of Q28.
5) Press the Upper Keyboard Flute 8 tab. This provides an A-440 reference pitch.
6) Adjust the expression pedal and Orchestration Volume Control for a comfortable listening level.
7) With a non-metalic tuning wand, adjust Oscillator 1 Tuning Adjust L1 for a zero beat with the A pitch.
8) Turn test switch three off then on.
9) Voice 2 may now be tuned by adjusting L2.
10) Each time test switch three is toggled, the tuning frequency increments to the next voice channel. (Voice six wraps around to voice one.)
11) When all six channels have been checked and/or adjusted, exit from the test mode as follows:
    a) Turn the test switches off.
       Note: If it is desired, the lamp chase routine may be enabled by placing test switch two on.
    b) Turn the organ off, then on to restore normal operation.
12) Remove jumper wire from Q28 on Board 24.

REFERENCE VOLTAGE PREAMP

The DC voltage output from the Reference Voltage Preamp is applied to a comparator to determine the duty cycle of the pulse wave.

1) Enter tuning mode as follows:
   a) Turn organ off.
   b) Place test switches (shown on Schematic 15, Board 31) off.
   c) Turn test switch one and test switch three on.
2) Turn organ on. Orch. Plus Voice 1 produces an A pitch (440Hz).
3) Toggle test switch three as required to select channel to be checked.
   Each time test switch three is toggled off then on, the frequency increments to the next voice channel (voice six wraps around to voice one).
4) Connect an oscilloscope to the emitter of the Audio Emitter Follower of the voice to be checked.
5) Waveform should have approximately .75mS pulse width, repetition rate = 2.2mS.
6) If adjustment is required:
   a) Turn organ off.
   b) Remove the factory tailored resistor from the input of the Reference Voltage Preamp.
   c) Install a decade box, resistor substitution box or potentiometer (approximately 400K) in place of the tailored resistor.
   d) Turn organ on and toggle switch 3 (as required) to the channel being adjusted.
   e) Adjust the resistor value to obtain a pulse width of approximately .75mS.
   f) Install the equivalent fixed resistor and recheck the pulse width. Remember to toggle switch 3 (if required) to the channel being adjusted.
7) Turn test switch three off then on.
8) The next voice may be checked beginning with step 4.
9) To return to normal operations:
   a) Turn the test switches off.
      Note: If it is desired, the lamp chase routine may be enabled by placing test switch two on.
   b) Turn the organ off and then on to restore normal operation.

SCHEMATIC 21
Board 25A & 25B

FILTER CONTROL PULSE WIDTH MODULATOR

1) Enter the tuning mode as follows:
   a) Turn organ off.
   b) Place test switches (shown on Schematic 15, Board 31) off.
   c) Turn test switch one and test switch three on.
2) Turn organ on. Voice 1 produces an A (440Hz) pitch.
3) Connect an oscilloscope to the test point at the output of the Inverting Buffer (IC12 Pin 3, IC45 Pin 11, IC13 Pin 11). The pulse width should be approximately .2uS with a repetition rate of about 5uS.
4) If adjustment is required:
   a) Remove the tailored resistor from the emitter of Filter Control Pulse Width Modulator and insert a decade box, resistor substitution box or potentiometer in place of the tailored resistor.
   b) Adjust the value of the variable resistor to obtain a pulse width of .2uS.
   c) Install the equivalent fixed resistor and recheck the pulse width.
5) Turn test switch three off then on.
6) The next channel may be checked or adjusted beginning with step three.
7) To return from the tuning mode.
   a) Turn test switches off.
      Note: If it is desired, the lamp chase routine may be enabled by placing switch two on.
   b) Turn organ off then on to restore normal operation.

MODULATOR THUMP ADJUSTMENT

1) Enter De-Thumping mode as follows:
   a) Turn organ off.
   b) Turn all test switches (shown on Schematic 15, Board 31) off.
   c) Turn test switch one, three and seven on.
2) Turn all six audio switches off (Board 25A and 25B).
3) Turn organ on.
4) Turn Voice 1 audio switch on.
5) Adjust Modulator Thump Adjust for minimum thump.
6) Turn Voice 1 audio switch off.
7) Repeat steps 4, 5 and 6 for Voice two through six.
8) To return from De-thumping mode:
   a) Place test switches off.
      Note: If the lamp chase routine is desired, place test switch two on.
   b) Turn organ off then on to restore normal operation.
9) Turn all six audio switches on.

SCHEMATIC 22
Board 16

ORCHESTRAL SYMPHONIZER MASTER OSCILLATOR TUNING PROCEDURE

1) Check the tuning of the Main Oscillator. (See Main Oscillator Tuning Procedure.)
2) Press the 16' Trombone tab and the Orchestral Symphonizer Trumpet preset.
3) Set the Orchestral Tuning and Orchestral Volume Controls to midpoint.
4) Hold down the upper keyboard C2 key.
5) Tune the Orch. Symp. Master Oscillator Tuning Coil with a non-metalic tuning wand for a zero beat.
6) This completes the tuning of the Orchestral Symphonizer.
7) Go to the Solo Oscillator Tuning Procedure and begin with Step 3.

SCHEMATIC 23
Board 17

ORCHESTRAL SYMPHONIZER GLIDE ADJUST

When an orchestral symphonizer preset (except grand piano, clavecin or harpsichord) is on and

the glide switch is pressed, the note being played should detune by one semitone (i.e., C detunes to B).
If adjustment is required:
1) Remove the factory selected resistor from the base circuit of Q27.
2) Insert a resistor substitution box, decade box or potentiometer in place of the selected resistor.
3) Adjust value to obtain one semitone detuning when the glide switch is pressed.
4) Determine the value of the substitute resistor then install the equivalent fixed resistor.
5) Recheck the glide.

SCHEMATIC 24
Board 17

INITIAL FREQUENCY ADJUST
1) Set Orchestral Symphonizer Volume Control to full volume.
2) Press Orch. Symp. Trumpet Preset
3) On Board 1, connect oscilloscope to S5-2 (Brass Volume Regulator Emitter Follower Q16).
4) Press and hold the upper C3 keyswitch.
5) Turn the Initial Frequency Adjustment full clockwise and observe the peak-to-peak voltage.
6) Turn the Initial Frequency Adjustment full counterclockwise and observe the peak-to-peak voltage.
7) Adjust the Initial Frequency Adjustment for the midpoint of the maximum and minimum peak-to-peak levels.

SCHEMATIC 25
Board 1

VOLTAGE CONTROLLED FILTER THUMP ADJUSTMENT
1) Turn organ off.
2) Unplug S2 (Board 1).
3) Turn organ on.
4) Place Orchestral Volume Control at full volume.
5) Place expression pedal at full expression.
6) Turn Wow Preset on.
7) Hold down the upper C1 keyswitch.
8) Repeatedly press the C5 keyswitch and adjust the thump adjust VR2 for minimum thump.
9) Turn organ off and re-insert S2.

BIAS ADJUST
To adjust the bias:
1) Press the Orchestral Symphonizer French Horn preset.
2) Play a chord on the upper keyboard.
3) Turn bias adjust clockwise until distortion occurs.
4) Observe position of potentiometer then turn the bias adjust counterclockwise until distortion occurs.
5) Proper setting is the midpoint between the distortion regions.

SCHEMATIC 26
Board 12

GLIDE ADJUSTMENT
When a solo symphonizer preset (except piano or clavecin) is on and the glide switch is pressed, the note being played should detune by one semitone (i.e., C detunes to B).

If adjustment is required:
1) Remove the factory tailored resistor from pin 6 of IC22.
2) Insert a resistor substitution box, decade box or 500K potentiometer in place of the tailored resistor.
3) Adjust value to obtain one semitone detuning when the glide switch is pressed.
4) Determine the value of the substitute resistor then install the equivalent fixed resistor.
5) Recheck the glide.

SOLO OSCILLATOR TUNING PROCEDURE

1) Check the tuning of the Main Oscillator. (See Main Oscillator Tuning Procedure).
2) Check the tuning of the Orch. Symp. Master Oscillator. (See Orch. Symp. Master Oscillator Tuning Procedure.)
3) Press the 16' Trombone tab and the Solo Symphonizer Trombone preset.
4) Set the Solo Tuning and Solo Volume Controls to midpoint.
5) Hold down the upper keyboard C2 key.
6) Adjust the Solo Oscillator Tuning Coil using a non-metalic tuning wand for a zero beat.
7) This completes the Solo Oscillator Tuning Procedure.
8) Go to the Orchestra Plus Tuning Procedure.

SCHEMATIC 30
Board 9

MAXIMUM VOLUME ADJUSTMENT

1) Press upper Trombone and Clarinet tabs.
2) Place Expression Pedal at maximum (full volume).
3) Press the upper C1, E1, G2, A#2 and C2 keyswitches simultaneously (C7 chord).
4) Adjust Maximum Volume potentiometer for maximum volume or lower without audible distortion.

MINIMUM VOLUME ADJUSTMENT

1) Press lower Piano tab and turn Genie Volume Control to maximum.
2) Place expression pedal at minimum (softest volume).
3) Press lower C2 keyswitch.
4) Adjust Minimum Volume potentiometer until the audio signal is barely audible.

SCHEMATIC 31

AMPLIFIER BIAS ADJUSTMENT

[To be performed after replacement of amplifier components.]

1) Turn off power, remove back and lower the Power Supply/Amp tray.
2) Connect a milliammeter as follows: positive lead to +55 volt terminal and negative lead to the collector of Q14 side of the fuse holder.
3) Ground audio input to amplifier at S1-2.
4) Turn on power and allow Power Supply to stabilize.

CAUTION: In the following steps, failure to use a non-conductive extraction tool may result in personal injury or damage to the instrument.

5) Remove the 3-amp fuse located on the Amplifier Board using a fuse puller or other non-conductive extractor.
6) Current should read between 20 and 30mA. (If current reading is correct, proceed to Step 15.)
7) If adjustment is necessary, turn off power and remove the factory-tailored resistor.
8) Connect a variable resistor (decade box, potentiometer, resistor substitution box, etc.) to the wire wrap pins. The initial value should be approximately 10K ohms.
9) Re-insert fuse into holder.
10) Turn on power and allow power supply to stabilize.
11) Remove the 3-amp fuse located on the Amplifier Board using a fuse puller or other non-conductive extractor.
12) Adjust variable resistor for a current reading of 25mA.
13) Turn off power and solder proper resistor to wire wrap pins. Re-insert fuse into holder.
14) Continue checkout procedure with Step 4.
15) Turn off power, remove milliammeter and ground leads, insert fuse.

SCHEMATIC 32
Board 50

+15 VOLT REGULATOR ADJUSTMENT

Connect a DC voltmeter to Lug 21 (Board 50). Voltage should measure +15VDC.

If adjustment is required:
1) Turn organ off.
2) Remove the tailored resistor and insert a decade box resistor substitution box or potentiometer.
3) Turn organ on and adjust variable resistor for a +15VDC indication on the voltmeter.
4) Turn organ off.
5) Remove the variable resistor and insert the equivalent fixed resistor.
6) Turn organ on and recheck Lug 21 for +15VDC.

+5 VOLT REGULATOR ADJUSTMENT

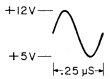
Connect a DC voltmeter to Lug 36 (Board 50). Voltage should measure +5 volts DC.

If adjustment is required:
1) Turn organ off.
2) Remove the tailored resistor from pins 5 and 6 of IC1 and insert a decade box, resistor substitution box or potentiometer in place of the tailored resistor.
3) Turn organ on and adjust variable resistor for a +5VDC indication on the voltmeter.
4) Turn organ off.
5) Remove the variable resistor and insert the equivalent fixed resistor.
6) Turn organ on and recheck Lug 36 for +5VDC.

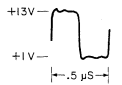
SCHEMATIC 1

BOARD 20

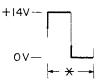
1 MASTER OSCILLATOR
Emitter Q1



2 TOS INPUT
IC13 Pin 2
(Test Point)



3 TYPICAL DIVIDER OUTPUT



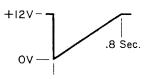
* Frequency depends on output being observed.

SCHEMATIC 2

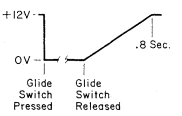
BOARD 8

1 CHORUS OSCILLATOR KEYDOWN DELAY
Collector Q8

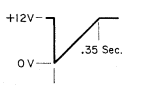
Orchestral Percussion
Hawaiian Guitar
Preset On



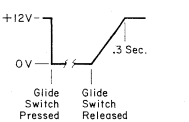
Orchestral Percussion
Hawaiian Guitar
Preset On



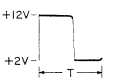
Orchestral Percussion
Violin
Preset On



Orchestral Percussion
Violin
Preset On

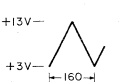


2 VOLTAGE CONTROLLED OSCILLATOR
IC4 Pin 1



Orch. Perc. Preset	T_{min}	T_{max}
Violin	4.8µS	5µS
H. Guitar	3.6µS	5µS

3 CHORUS OSCILLATOR
IC2 Pin 6



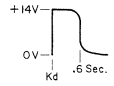
SCHEMATIC 3

BOARD 18

1 VIBRATO DELAY TRIGGER

IC1 Pin 11

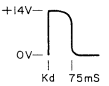
Vibra Harp Preset On



2 SUSTAIN CANCEL TRIGGER

IC1 Pin 3

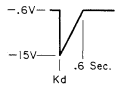
Any Percussion Preset except Chimes or Bells



3 SYMPHONIC STRING MODULATOR DRIVER

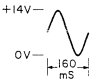
Emitter Q34

Upper String Preset On
Upper String Attack Tab On



4 VIBRATO OSCILLATOR

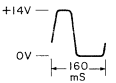
Emitter Q2



5 LOW FREQUENCY FLUTE LAMP DRIVER

Emitter Q14

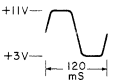
Normally = +14V
Vibra Trem Flute Tab On



6 VIBES/VIBRA HARP LAMP DRIVER

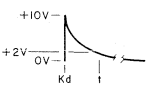
Emitter Q15

Normally = Zero
Vibes or Vibra Harp On



7 PERCUSSION/REPEAT DRIVERS

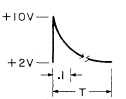
S4 Pin 1



Preset	Normal t Sec	Perc. long t Sec
4' Harm.*	.25	.5
2 2/3' Harm.*	.25	.5
Bells *	.25	.5
Vibes	.5	.5
H. Guitar	.5	.5

* Repeat Preset

Repeat Tab On
Bells Preset On



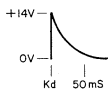
Repeat Speed	T Sec
Min	.25
Max	.08

SCHEMATIC 3 (Cont.)

BOARD 18

8 KEYDOWN PULSE DRIVER

Emitter Q16

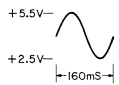


Decay at the Cathode of D9 = 20 Sec

9 VIBRATO/GLIDE DRIVER

Emitter Q4

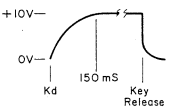
Normally = +3.6V
Glide Switch pressed = +10V
Vibrato Tab On



7 SLOW ATTACK DRIVER

S4 Pin 1

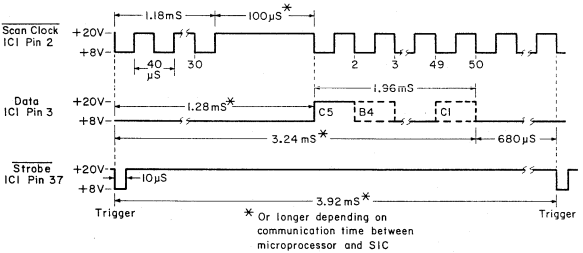
Violin or Accordion Preset On



BOARD 24

8 UPPER KEYBOARD DECODER TIMING

Connect S9-3 (Keyer Strobe) to External Trigger Input of Oscilloscope
Trigger – Negative Edge
Time Base = .5 mS/Div.
Use high impedance probe (10:1)
Upper C5 Keyswitch Pressed and held



* Or longer depending on communication time between microprocessor and SIC

SCHEMATIC 4

BOARD 10

1 UPPER KEYBOARD FLUTE MIXING PREAMP

Connect Oscilloscope to S11-2

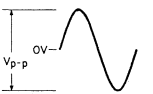
Upper A2 Keyswitch Pressed

Flute Tab	Amplitude Volts (Peak to Peak)
16	.88
8	.5
5 1/3	.48
4	.44
2 2/3	.46
2	.38
1	.38

Custom Flute Preset Tab On
Selected Preset Volume Control = Max

Flute Volume Control	Amplitude Volts (Peak to Peak)
16	.8
8	.44
5 1/3	.42
4	.38
2 2/3	.42
2	.34
1	.34

TYPICAL FLUTE WAVEFORM



2 FLUTE PREAMPS

Upper A2 Keyswitch Pressed

Board	Footage	Filter	Connect Scope	Amplitude Volts (Peak to Peak)
10	16	IC3 Pin 10	S1-6	1.4
10	8	IC2 Pin 12	S11-1	1.5
6	5 1/3	IC1 Pin 12	S3-5	1.4
10	4	IC2 Pin 3	S4-9	1.3
6	2 2/3	IC1 Pin 10	S3-3	1.4
6	2	IC1 Pin 4	S3-1	1.2
6	1	IC1 Pin 3	S3-2	1.2

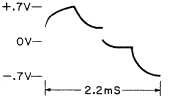
3 REED/STRING PREAMPS

Upper A2 Keyswitch Pressed
Input Coupling — AC

Footage	Connect Scope	Amplitude Volts (Peak to Peak)
16	IC3 Pin 3	.9
8	IC2 Pin 10	1.2
4	IC2 Pin 4	1.1

4 8' HARMONIC MIXER

IC1 Pin 4
Connect Oscilloscope to S4-6
Kinura or Accordion On
Upper A2 Keyswitch Pressed



5 LOW FREQUENCY FLUTE PREAMP

Connect Oscilloscope to S1-8
Flute 16' Tab On
Upper A1 Keyswitch Pressed

Amplitude = .34V p-p

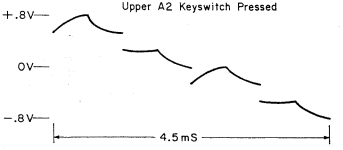
6 VIBES / VIBRA HARP PREAMP

IC3 Pin 12

Connect Oscilloscope to S1-2
Amplitude Modulated Audio Envelope
Vibes or Vibra Harp Preset On
Upper A2 Keyswitch Pressed

7 16' HARMONIC MIXER

IC1 Pin 10
Connect Oscilloscope to S4-4
Cornet or Trombone Tab On
Upper A2 Keyswitch Pressed

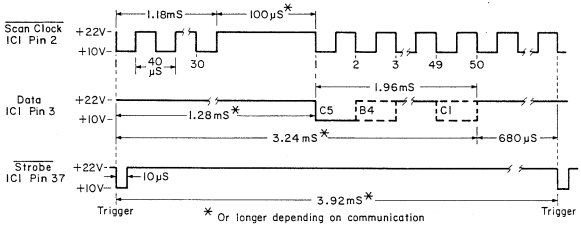


SCHEMATIC 5

BOARD 23

UPPER FRACTIONAL KEYER TIMING

Connect S10-4 (Keyer Strobe) to External Trigger Input of Oscilloscope
Trigger – Negative Edge
Time Base = .5mS/Div.
Use high impedance probe (10:1)
Upper C5 Keyswitch pressed and held



* Or longer depending on communication time between microprocessor and SIC

SCHEMATIC 6

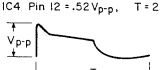
BOARD 10

1 UPPER VIOLINA PREAMP

IC4 Pin 3 = .36 $V_{p\text{-}p}$, T = 1.1mS

UPPER VIOLA PREAMP

IC4 Pin 12 = .52 $V_{p\text{-}p}$, T = 2.25mS



Upper A2 Keyswitch Pressed

2 UPPER SYMPHONIC STRING PREAMP

IC4 Pin 4
Connect Oscilloscope to S8-1
Upper A2 Keyswitch Pressed

Preset	Amplitude Volts (Peak to Peak)
Violina	.44
Viola	.5
Cello	.45

3 UPPER SYMPHONIC STRING OUTPUT AMPLIFIER

Emitter Q4
Upper String Volume Control = Max
Connect Oscilloscope to S8-3
Upper A2 Keyswitch Pressed

Preset	Amplitude Volts (Peak to Peak)
Violina	.7
Viola	1.0
Cello	.8

SCHEMATIC 7

BOARD 3

GENIE ACCENT TRUTH TABLE

LOWER TABSWITCH			Normal Modulation	Accent
Piano	Guitar	Banjo		
ON	ON	OFF	Piano	Guitar
ON	OFF	ON	Piano	Banjo
OFF	ON	ON	Guitar	Banjo
ON	ON	ON	Piano & Guitar	Banjo

1. At least two lower keyboard tabs pressed. (Piano, Guitar, Banjo)
2. Rhythm playing.

SCHEMATIC 7 (Cont.)

BOARD 3

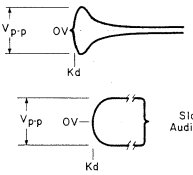
1 UPPER KEYBOARD PERCUSSION PREAMP

Connect Oscilloscope to SI-14
Upper A2 Keyswitch Pressed

Orchestral Percussion Preset	Amplitude at Keydown (Peak to Peak)
4' Harmonic	3.6V
$2\frac{2}{3}$' Harmonic	4 V
Bells	4.8V
Vibes	7V/4V *
Vibra Harp	4 V
Chimes	1.3V
Accordion	2 V
H. Guitar	4V/2.2V *
Violin	1.8V

*At Keydown/After Decay

Percussion Audio Envelope



Slow Attack Audio Envelope

2 LOWER KEYBOARD PREAMP

Connect Oscilloscope to SI-2
Lower A2 Keyswitch Pressed

Genie Voice Tab	Amplitude Volts (Peak to Peak)
Piano	1.6
Guitar	1.8
Banjo	1.5

3 VOX HUMANA PREAMP

Connect Oscilloscope to SI-3
Lower A2 Keyswitch Pressed
Vox Humana Tab On

Volume Tab	Amplitude Volts (Peak to Peak)
Soft	.15
Lower Med	.3
Lower Full	.5

4 REED/STRING PREAMP

Connect Oscilloscope to S2-7

Percussion Volume Control-Maximum
Upper A2 Keyswitch Pressed

Tab or Preset	Amplitude Volts (Peak to Peak)
Trombone	1.5
Clarinet	1.7
Cornet	2.4
Kinura	1.6
4' Harmonic	2.5 *
$2\frac{2}{3}$' Harmonic	2.6 *
Bells	3.2
Vibes	5.5/3.2 *
Vibra Harp	3.0
Chimes	1.0
Accordion	1.6
H. Guitar	3.0/1.5
Violin	1.3

*Keydown after decay

Genie Volume Control-Maximum
Lower A2 Keyswitch Pressed

Tab	Amplitude Volts (Peak to Peak)
Piano	2.2
Guitar	2.5
Banjo	2.2

SCHEMATIC 8

BOARD 7

1 LOWER KEYBOARD PREAMPS

Lower A3 Keyswitch Pressed

	Preamp	Connect Scope	Amplitude Volts (Peak to Peak)
2'	IC1 Pin 4	S6-1	1.3
4'	IC2 Pin 4	S5-6	1.1
8'	IC2 Pin 10	S7-15	1.2
Diapason	IC1 Pin 3	S5-4	2.1
* Harmonic Mixer	IC2 Pin 3	S5-5	1.2

* Input coupling AC

2 FLUTE MIXING PREAMP

IC1 Pin 12
Connect Oscilloscope to S7-5

Upper A2 Keyswitch Pressed
Upper Flute 8 Tab On
Amplitude = .22 V_{p-p}

Lower A3 Keyswitch Pressed
Lower Flute 8 Tab On

Volume Switcher	Amplitude Volts (Peak to Peak)
OFF	.1
MED.	.18
FULL	.36

3 LOWER KEYBOARD FLUTE PREAMP

IC1 Pin 10

Lower A3 Keyswitch Pressed

Tab	Amplitude Volts (Peak to Peak)
2'	.75
4'	.7
8'	.7

Custom Flute Preset Tab On
Lower A3 Keyswitch Pressed

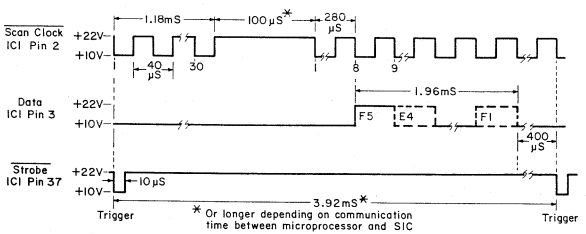
Custom Vol. Control (Max)	Amplitude Volts (Peak to Peak)
2'	.7
4'	.65
8'	.7

SCHEMATIC 9

BOARD 21

1 LOWER KEYBOARD DECODER TIMING

Connect S9-10 (Keyer Strobe) to External Trigger Input of Oscilloscope
Trigger — Negative Edge Time Base = .5mS / Div.
Use high impedance probe (10:1) Lower F5 Keyswitch Pressed and held



SCHEMATIC 9 (Cont.)

BOARD 7

2 LOWER KEYBOARD STRING PREAMPS

Lower Symphonic String Volume Control = Max.
Lower A3 Keyswitch Pressed

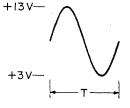
Lower Preset	Connect Oscilloscope	
	S8-2	S8-5
Violina	.7 V_{p-p}	1.4 V_{p-p}
Viola	1.0 V_{p-p}	2.1 V_{p-p}

SCHEMATIC 10

BOARD 5

1 LOW SPEED OSCILLATOR

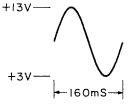
IC1 Pin 1



Normal T = 1.5 Sec.
Chorus Celeste Tab On T = 2.2 Sec.

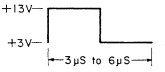
2 HIGH SPEED OSCILLATOR

IC2 Pin 1



3 VOLTAGE CONTROLLED OSCILLATOR

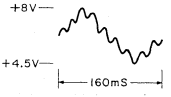
Collector Q4 or Q6
Chorus Celeste Tab On



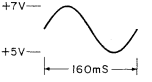
166 KHz to 333 KHz

4 CHORUS OSCILLATOR MIXER

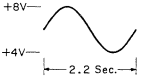
IC1 Pin 7
Chorus Tabs Off = +7 VDC



Flute Chorus Tab On



Vibra Trem Flute Tab On



Chorus Celeste Tab On

SCHEMATIC 11

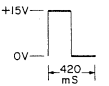
BOARD 4

1 FAST CLOCK

IC1 Pin 10

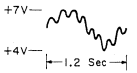
2 SLOW CLOCK

IC1 Pin 4



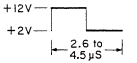
3 TYPICAL VCO DRIVER

IC2 Pin 1, IC3 Pin 1 or IC4 Pin 1



4 TYPICAL VCO OUTPUT

Collector Q6, Q10 or Q14
Chorus Celeste Tab On



222 KHz to 385 KHz

SCHEMATIC 12

BOARD 19

1 DOUBLE BASS PREAMP

IC4 Pin 7

Connect Oscilloscope to S3-4
Pedal A Key Pressed
Double Bass Preset On

Amplitude = 9 Vp-p

2 BASS PREAMP

IC4 Pin 1
Connect Oscilloscope to S3-3
Pedal A Key Pressed

Pedal Tab	Amplitude Volts (Peak to Peak)		
	Soft	Bass Med Tab	Bass Full Tab
16	1.2	2.2	5.2
8	.5	1.1	2.4
Diapason	.28	.6	1.4
Diaphone	.6	1.2	2.7
Guitar Bass	.5	1.1	2.4

Symphonic Bass

Piano	1.9 *	4.0 *	9.0 *
Bass Fiddle	1.2 *	2.5 *	5.0 *
Tuba	2	4.5	10

* At Keydown

3 BASS MIXING PREAMP

IC4 Pin 14
Pedal A Key Pressed

Pedal Tab	Amplitude Volts (Peak to Peak)
16	6.0
8	2.8
Diapason	1.5
Diaphone	3.2
Guitar Bass	2.8

Symphonic Bass

Piano	10.0 *
Bass Fiddle	6.0 *
Tuba	12.0

* At Keydown

SCHEMATICS 13, 14

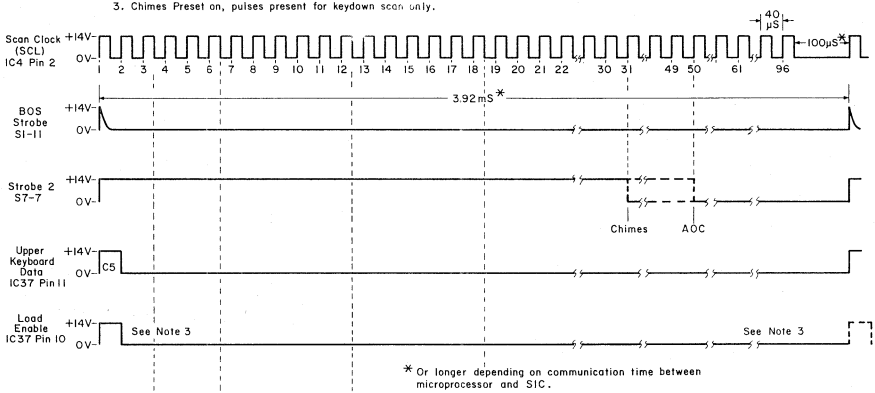
BOARD 15

5 PERCUSSION/AOC WINDOW GENERATOR

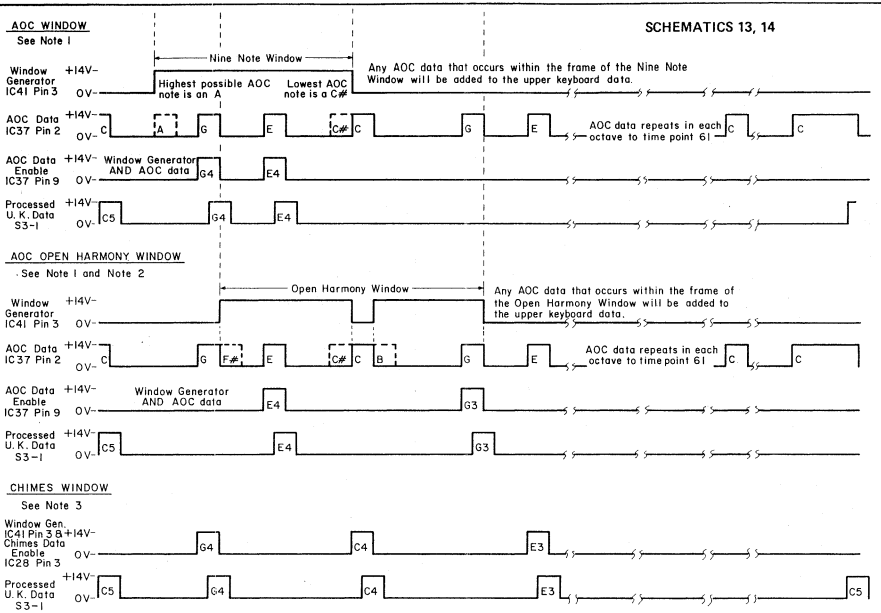
Connect S1-11 (BOS Test Point) to External Trigger Input of oscilloscope. Trigger = Positive Edge

Notes:

1. AOC tab on, Magic Chord tab on, Lower Keyboard C Chord pressed, Upper Keyboard C5 key pressed & held.
2. Turn on AOC Open Harmony tab.
3. Chimes Preset on, pulses present for keydown scan only.


40 µS
100µS*
Scan Clock (SCL) IC4 Pin 2
+14V
0V
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 30 31 49 50 61 96
3.92mS*
BOS Strobe S1-11
Strobe 2 S7-7
Chimes
AOC
Upper Keyboard Data IC37 Pin 11
C5
Load Enable IC37 Pin 10
See Note 3
See Note 3

* Or longer depending on communication time between microprocessor and SIC.

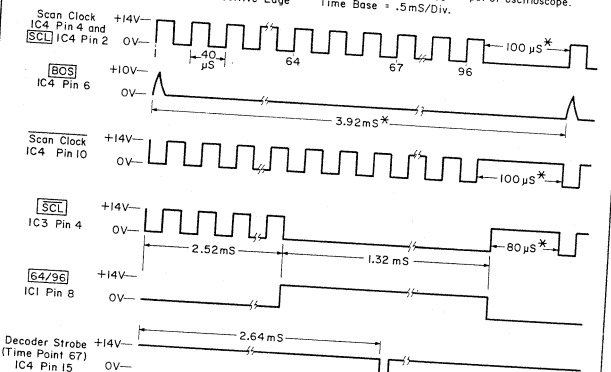

AOC WINDOW
See Note 1
Nine Note Window
Window Generator IC41 Pin 3
+14V-
0V-
Highest possible AOC note is an A
Lowest AOC note is a C#
Any AOC data that occurs within the frame of the Nine Note Window will be added to the upper keyboard data.
AOC Data IC37 Pin 2
AOC data repeats in each octave to time point 61
AOC Data Enable IC37 Pin 9
Window Generator AND AOC data
Processed U.K. Data S3-1
AOC OPEN HARMONY WINDOW
See Note 1 and Note 2
Open Harmony Window
Any AOC data that occurs within the frame of the Open Harmony Window will be added to the upper keyboard data.
CHIMES WINDOW
See Note 3
Window Gen. IC41 Pin 3 & Chimes Data Enable IC28 Pin 3

SCHEMATIC 13 & 14

BOARD 15

1 KEYBOARD ENCODER CLOCK AND STROBE TIMING

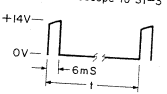
Connect S1-11 (BOS Test Point) to External Trigger input of oscilloscope.
Trigger – Positive Edge Time Base = .5mS/Div.



* Or longer depending on communication time between microprocessor and SIC

2 REPEAT ÷2 SWITCHER

Collector Q10
Connect oscilloscope to S1-3

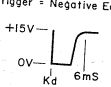


Repeat Speed min. t=260mS
Repeat Speed max. t = 86mS

BOARD 17

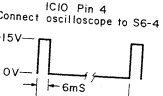
3 KEYDOWN RESET

Collector Q12
Press any Upper Keyboard Key
Trigger = Negative Edge



4 REPEAT OSCILLATOR

IC10 Pin 4
Connect oscilloscope to S6-4



Repeat Speed min. t = 130mS
Repeat Speed max. t = 43mS

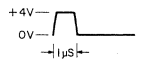
SCHEMATIC 15

BOARD 32

1 IO/$\overline{M}$

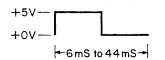
In-Out / Memory

IC1 Pin 34



2 RHYTHM CLOCK

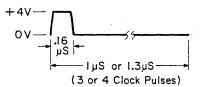
IC1 Pin 7



3 ALE

Address Latch Enable

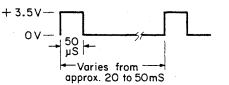
IC1 Pin 30



4 TRAP

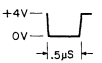
IC1 Pin 6

Connect Oscilloscope to SII-1



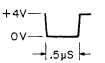
5 READ

IC1 Pin 32



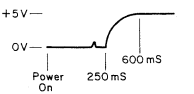
6 WRITE

IC1 Pin 31



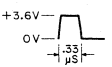
7 POWER ON RESET

IC1 Pin 36



8 CLOCK

IC1 Pin 37

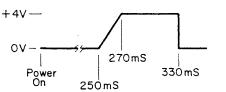


9 CRYSTAL

IC1 Pin 1

10 RESET

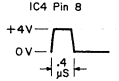
IC1 Pin 3



BOARD 31

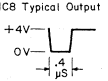
11 DELAYED WRITE

IC4 Pin 8



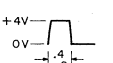
12 CHIP SELECT DECODER

IC8 Typical Output



13 TYPICAL ROM SELECT DECODER OUTPUT

IC17 Pin 1



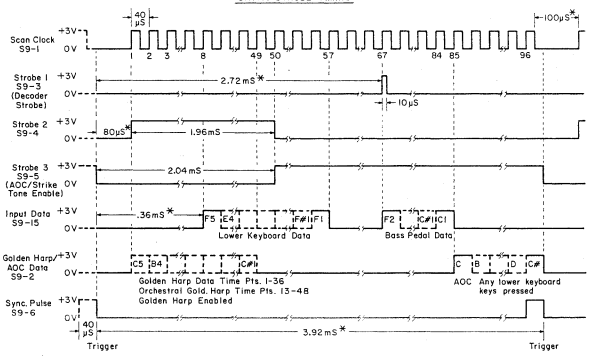
SCHEMATIC 15

BOARD 32

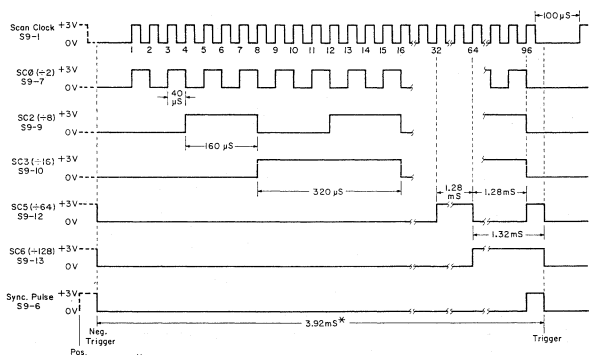
I4 SERIAL INTERFACE CONTROLLER II (Keyboard Encoder) IC25

Connect S9-6 (Sync. Pulse) to External Trigger Input of Oscilloscope
Trigger = Negative Edge Time Base = .5mS/Div.

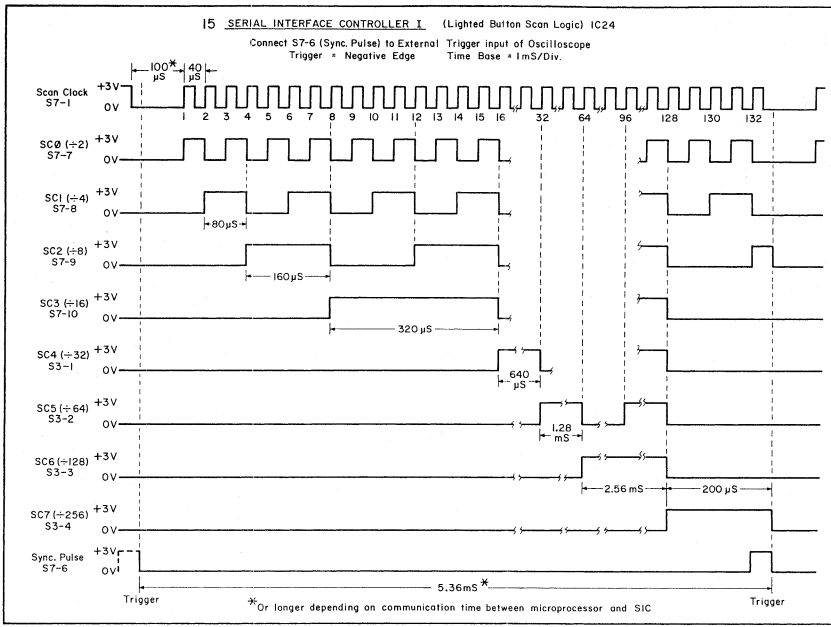
DATA / STROBE TIMING



SCAN CLOCK DIVIDER TIMING



*Or longer depending on communication time between microprocessor and SIC


15 SERIAL INTERFACE CONTROLLER I (Lighted Button Scan Logic) IC24
Connect S7-6 (Sync. Pulse) to External Trigger input of Oscilloscope
Trigger = Negative Edge
Time Base = 1mS/Div.
100* µS
40 µS
Scan Clock S7-1
SC0 (÷2) S7-7
SC1 (÷4) S7-8
SC2 (÷8) S7-9
SC3 (÷16) S7-10
SC4 (÷32) S3-1
SC5 (÷64) S3-2
SC6 (÷128) S3-3
SC7 (÷256) S3-4
Sync. Pulse S7-6
+3V
0V
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 32 64 96 128 130 132
80µS
160µS
320µS
640 µS
1.28 mS
2.56 mS
200 µS
5.36mS*
Trigger
Trigger
*Or longer depending on communication time between microprocessor and SIC

SCHEMATIC 16

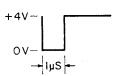
BOARD 30

1

TYPICAL CHIP SELECT DECODER OUTPUT

IC14 or IC15

NOTE: These pulses are extremely difficult to observe because they occur only when the data in a PIC is being up dated.

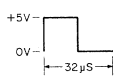


SCHEMATIC 17

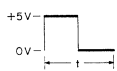
BOARD 30

PROGRAMMABLE OSCILLATOR PERIPHERAL

1 IC2 Pin 4

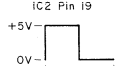


2 IC2 Pin 20



Rhythm Speed min. t = 44mS, max. t = 6.4mS

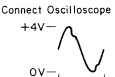
3 IC2 Pin 19



Rhythm Speed min. t = 340μS, max. t = 50μS

4 4 MHz OSCILLATOR

IC1 Connect Oscilloscope to S7-2



SCHEMATIC 18

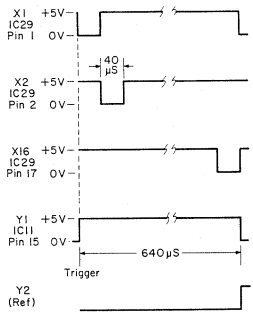
BOARD 32

1

X-SCAN, Y-SCAN TIMING DIAGRAM

Connect S3-1 to External Trigger Input of Oscilloscope

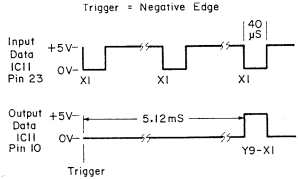
Trigger = Positive Edge



2 Y-LINE SELECT MULTIPLEXER

NOTE: Data present only when pushbutton pressed & held or scan tabswitch is pressed

Connect S3-4 to External Trigger Input of Oscilloscope
Magic Key Memory Tab On
Trigger = Negative Edge



SCHEMATICS 19, 20, 21

BOARD 25A, 25B

1. Turn organ off.
2. Place the Test Switches (shown on Schematic 15, Bd. 31) to the off position.
3. Place switch 1 on.
4. Turn organ on.
5. Place switch 3 on, Orch. Plus Voice 1 now outputs an audio frequency (440 Hz).
6. Take readings if desired.
7. Place switch 3 off then on, Orch. Plus Voice 2 now outputs an audio frequency (440 Hz).

Each time switch 3 is toggled the frequency increments to the next channel. (Voice 6 moves to Voice 1)

At conclusion of measurements:

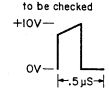
1. Place the test switches off.
2. Turn organ off then on to restore normal operation.

Component refererences for waveforms shown below

Voice	Master Oscillator Collector	Prog. Oscillator IC29	Pulse Width Flip-Flop	Sawtooth Generator	Audio Attenuators	Audio Emitter Follower	Filter Input Preamp	Audio Modulator
1,4	Q20	Pin 21	IC18 Pin 3	Q38	Q39, Q34	Q35	IC16 Pin 8	SI-4
2,5	Q21	Pin 4	IC39 Pin 3	Q30	Q31, Q26	Q27	IC22 Pin 7	SI-3
3,6	Q22	Pin 5	IC28 Pin 3	Q46	Q45, Q43	Q42	IC10 Pin 7	SI-2

1 MASTER OSCILLATOR

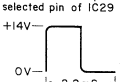
Connect Oscilloscope to collector of transistor to be checked



2 PROGRAMMABLE OSCILLATOR

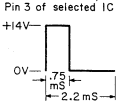
(Square Wave)

Connect Oscilloscope to selected pin of IC29



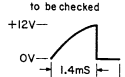
3 PULSE WIDTH FLIP-FLOP

Connect Oscilloscope to Pin 3 of selected IC



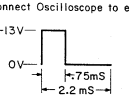
4 SAWTOOTH GENERATOR

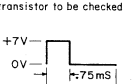
Connect Oscilloscope to emitter of transistor to be checked



5 AUDIO ATTENUATORS

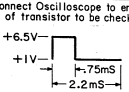
Connect Oscilloscope to emitter of transistor to be checked





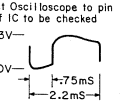
6 AUDIO EMITTER FOLLOWER

Connect Oscilloscope to emitter of transistor to be checked



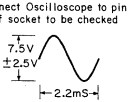
7 FILTER INPUT PREAMP

Connect Oscilloscope to pin of IC to be checked



8 AUDIO MODULATOR

Connect Oscilloscope to pin of socket to be checked



SCHEMATICS 19, 20, 21

BOARD 25A, 25B

PROGRAMMABLE OSCILLATOR PERIPHERAL

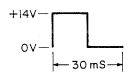
Filter Tune
Enter test mode as indicated above

Voice	Filter Tune Pulse Code	Filter Control Inverting Buffers	Keying Envelope Generator
1, 4	IC29 Pin 20	IC12 Pin 3	Q33
2, 5	IC24 Pin 14	IC45 Pin 11	Q25
3, 6	IC29 Pin 19	IC13 Pin 11	Q44

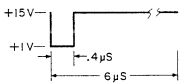
9 FILTER TUNE PULSE CODE

Connect Oscilloscope to desired pin of IC

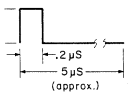
Voice 1,4; 3, 6



Voice 2, 5



10 INVERTING BUFFERS

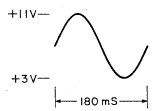


11 KEYING ENVELOPE GENERATOR

Emitter of transistor = +12 VDC

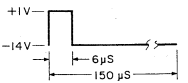
12 VIBRATO OSCILLATOR

IC6 Pin 7



13 GLIDE DISCHARGE SWITCHER

Collector Q10

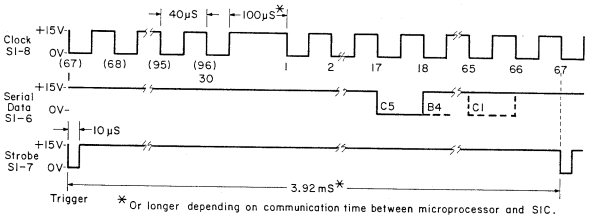


SCHEMATIC 22

BOARDS 13 & 14

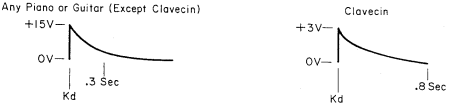
1 SERIAL TO PARALLEL DECODER TIMING DIAGRAM

Measurements taken on Board 14
Connect S1-7 (Strobe) to External Trigger Input of Oscilloscope
Trigger – Negative Edge C5 Keyswitch pressed and held Any Orch. Symp Preset On



2 ORCH. SYMP. KEYER DRIVER

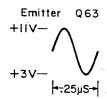
Connect Oscilloscope to Emitter Q2 (Board 14)
Press C1 Keyswitch



Connect Voltmeter to Emitter Q2 (Board 14)
Press C1 Keyswitch
Any Brass preset except Oboe or Krumet Horn – Emitter Voltage = +23 VDC
Oboe or Krumet Horn – Emitter Voltage = +7.5 VDC

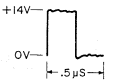
BOARD 16

3 ORCH. SYMP. MASTER OSCILLATOR



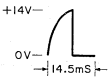
4 DIVIDER

IC1 Pin 12



5 SAWTOOTH KEYER

Orch. Symp. Brass Preset On
Connect Oscilloscope to anode of diode located near base of Pulse Keyer Transistor Q1
Press C1 Keyswitch

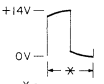


SCHEMATIC 22 (Cont.)

BOARD 16

6 TOP OCTAVE SYNTHESIZER

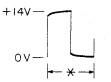
IC2 Typical Output



*Depends on output being observed.

7 FREQUENCY DIVIDER

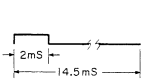
IC3-14 Typical Output

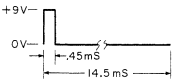


*Depends on output being observed.

8 PULSE KEYER

Orch. Symp. Brass Preset On
Connect Oscilloscope to collector of transistor to be checked Q1
Press C1 Keyswitch



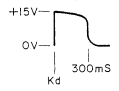


SCHEMATIC 23

BOARD 17

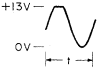
1 DELAY TRIGGER

IC10 Pin 11
Any Orch. Symp. Preset On



2 TREMOLO / VIBRATO OSCILLATOR

IC12 Pin 7



Orch. Symp. Trem. Speed Control
min t = 240mS
max t = 130mS

3 VIBRATO / GLIDE DRIVER

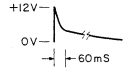
Emitter Q27

Normal = +5.5VDC

Glide Switch Pressed = +11VDC

4 REPEAT MODULATOR DRIVER

Emitter Q21



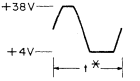
Repetition rate variable from 90mS to 270mS depending on position of Repeat Speed Control

5 ORCH. SYMP. DRIVER

Emitter Q14
Connect Oscilloscope to S2-8

Orch. Symp. Preset	VDC
Normal	+38
Clavecin	+10.5
Krumet Horn	+10.5
Oboe	+10.5

Orch. Symp. Tremolo Depth Control Maximum



*Variable from 130mS to 240mS depending on position of Orch. Symp. Trem. Speed Control

SCHEMATIC 24

BOARD 17

1 INITIAL FREQUENCY PREAMP, FILTER TUNING PREAMP, DRIVER

Connect voltmeter to IC9

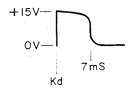
Preset	IC9 Pin 8	IC9 Pin 14	S5-1
Off	−.5V	+11.7V	−2.5V
Trumpet	−.9V	+2.7V	−11.6V
Brass Ensemble	−.8V	+1.8V	−13.7V/−11.2V*
Wow	−2.5V	+1.8V	−13.7V/−11.4V*

* Keydown/After Filter Sweep

2 FILTER ENVELOPE TRIGGER

IC7 Pin 3

Any Orch. Symp. Preset On



Orchestral Custom Preset On

Connect voltmeter to S5-1

Filter Tune	Filter Range	Envelope Sustain	Normal	Filter Follow On	
				C1 Key Pressed	C5 Key Pressed
1	1	1	−13.7V	−14.0V	−13.6V
1	1	8	−13.7V	−14.0V	−13.6V
1	8	1	−13.7V	−14.0V	− 5.8V
1	8	8	− 9.7V	−13.1V	− 8.4V
8	1	1	−11.0V	−13.4V	− 8.4V
8	1	8	−11.0V	−13.4V	− 8.4V
8	8	1	−11.0V	−13.4V	− 8.4V
8	8	8	−1.0V	−11.3V	− 1.8V

1 = Minimum 8 = Maximum

3 EMITTER FOLLOWER

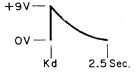
Emitter Q6

Orchestral Custom Symphonizer Preset On

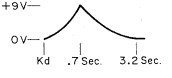
Attack = min.
Decay = min.
Sustain = min.

Attack = max.
Decay = min.
Sustain = min.

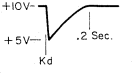
Attack = min.
Decay = max.
Sustain = min.



Attack = max.
Decay = max.
Sustain = min.



Attack = max.
Decay = max.
Sustain = max.



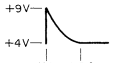
SCHEMATIC 24 (Cont.)

BOARD 17

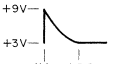
3 EMITTER FOLLOWER

Emitter Q6

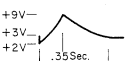
Orch. Symp. Trumpet Preset On



Orch. Symp. Brass Ensemble Preset On



Wow Preset On

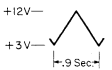


SCHEMATIC 25

BOARD 1

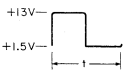
1 CHORUS SPEED OSCILLATOR

IC15 Pin 7



3 VOLTAGE CONTROLLED OSCILLATOR

Collector Q18



t_{max} = 3.8uS = 264 KHz

t_{min} = 3uS = 333 KHz

2 VOLUME REGULATORS

Input Coupling AC
Orch. Symp. Volume Maximum
Upper Keyboard A2 Keyswitch Pressed

Preset	String Regulator S5-1 Volts (Peak to Peak)	Brass Regulator S5-2 Volts (Peak to Peak)
Grand Piano	4.0*	.25*
Clavecin	2.2*	.3*
Harpsichord	1.2*	.1*
Banjo	4.2*	0
Trumpet	0	4.6
Brass Ensemble	0	3/1.8#
French Horn	1.9	.1
Electric Guitar	3*	.14*
Post Horn	0	2.6
Krumet Horn	0	1.6
Oboe	0	5.2
Mandolin	3*	.25*
Wow	0	1.9

*At Keydown

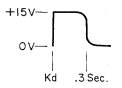
Peak/After Decay

SCHEMATIC 26

BOARD 12

1 DELAY TRIGGER

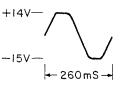
IC2 Pin 8



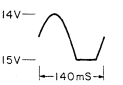
2 SOLO VIBRATO/TREMOLO OSCILLATOR

IC22 Pin 8
Connect Oscilloscope to S6-1

Solo Trem. Speed = min.

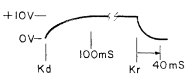


Solo Trem. Speed = max.



3 SLOW ATTACK DRIVER

Emitter Q5

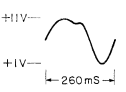


4 SLOW ATTACK DRIVER MODULATOR

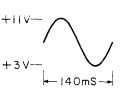
IC22 Pin 14

Trem. Depth minimum = +11V

Trem. Depth max.
Trem. Speed min.

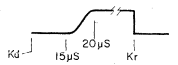


Trem. Depth max.
Trem. Speed max.



5 KEYER DELAY

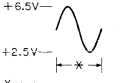
IC31 Pin 11
Any Solo Preset On



6 SOLO TUNING AND VIBRATO AMPLIFIER

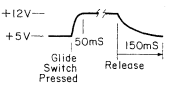
IC22 Pin 7

Tremolo Depth max.



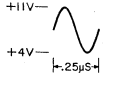
* Varies from 140mS to 260mS with Trem. Speed Control

Solo Trumpet Preset On
Tremolo Depth min.



7 SOLO MASTER OSCILLATOR

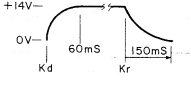
Emitter Q23



8 SOLO CLARINET DRIVER

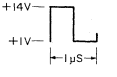
Emitter Q17

Solo Clarinet Preset On



9 DIVIDER

IC32 Pin 11

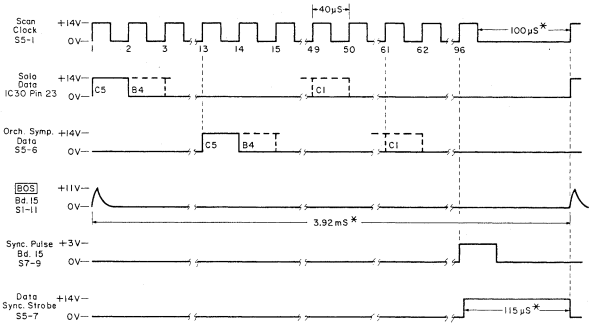


SCHEMATIC 26 (Cont.)

BOARD 12

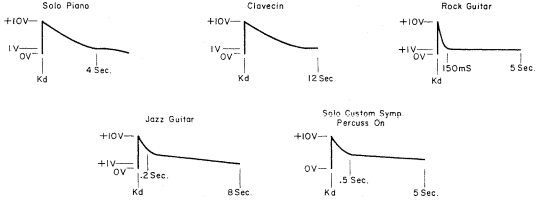
10 SOLO NOTE GENERATOR TIMING DIAGRAM

Connect BOS Test Point (S1-11, Board 15) to External Trigger input of oscilloscope.
Trigger = Positive Edge Press C5 Keyswitch
Any Solo Preset on, any Orch. Symp. Preset on.

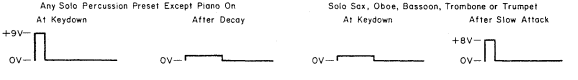


*Or longer depending on communication time between microprocessor and SIC.

11 PERCUSSION DRIVER
Emitter Q6



12 PULSE DRIVER
Emitter Q16



SCHEMATIC 27

BOARD 2

1 AUDIO MODULATOR

Connect Oscilloscope to IC28 Pin 8
Upper A2 Keyswitch Pressed

Solo Preset	IC28 Pin 8 Volts (Peak to Peak)	S3-8 Volts (Peak to Peak)
Piano	N/A	9*
Clavecin	N/A	5.5*
Rock Guitar	6.8*	8*
Sax	N/A	11
Oboe	N/A	8.5
Jazz Flute	5	6
Jazz Guitar	8.4*	10*
Clarinet	N/A	7
Bassoon	N/A	7.5
Trombone	10*/7.4	12.5*/9
Trumpet	12	15

* Keydown / After Decay

2 KEYING ENVELOPE MODULATOR

Solo Trumpet Tab On

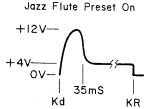
	Before Keydown	After Keydown
IC28 Pin12	-1.7VDC	+.6VDC

BOARD 12

3 NOISE DRIVER

Emitter Q9

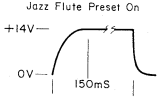
Jazz Flute Preset On



4 JAZZ FLUTE 8' DRIVER

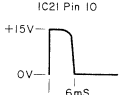
Emitter Q10

Jazz Flute Preset On



5 FILTER ENVELOPE TRIGGER

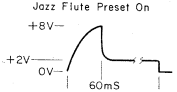
IC21 Pin 10



6 JAZZ FLUTE 4' DRIVER

Emitter Q7

Jazz Flute Preset On



7 SOLO CUSTOM SYMPHONIZER TUNING PREAMP & DRIVER

Solo Custom Symphonizer — On

Filter Tune	Filter Resonance	Filter Range	Envel. Attack	Envel. Decay	Envel. Sustain	IC23 Pin 8 VDC	Collector Q20 VDC	Collector Q20 Filter Follow = On, C1 Key Pressed VDC	Collector Q20 Filter Follow = On, C5 Key Pressed VDC
1	X	1	X	X	X	+.2	-12.8	-13.25	-12.7
8	X	1	X	X	X	+3	-10.25	-12.7	-8.4
1	X	8	X	X	1	+.3	-12.7	-13.25	-12.5
1	X	8	X	X	8	+4.3	-9.2	-12.5	-6.5
8	X	8	X	1	1	+5.5	-8.2	-12.5	-4.8
8	X	8	X	X	8	+14	-.9	-11.7	-1.4
8	X	8	X	8	1	+6	-7.7	-12.5	-4

1=Minimum
8=Maximum
X= Don't Care

7 FILTER TUNING PREAMP AND DRIVER

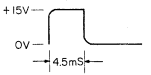
Solo Preset	IC23 Pin 8 VDC	Collector Q20 VDC
Jazz Guitar	+2.25	-12.8/-9.6*
Trombone	+1.1	-12
Trumpet	+2.5	-10.8
All Others	+14	-.9

* C1 Key/C5 Key Pressed

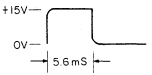
SCHEMATIC 28

BOARD 29

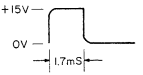
1 TOM TOM TRIGGER
IC9 Pin 11
Bosa Nova Playing



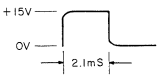
2 BASS DRUM TRIGGER
IC9 Pin 3
Bosa Nova Playing



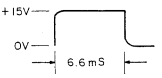
3 SNARE DRUM TRIGGER
IC8 Pin 4
Bosa Nova Playing



4 LOW DRUM TRIGGER
IC9 Pin 10
Bosa Nova Playing



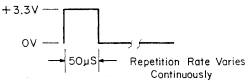
5 GENIE MODULATOR TRIGGER
IC8 Pin 11
Bosa Nova Playing



SCHEMATIC 29

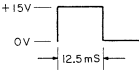
BOARD 28

1 TRAP ENABLE LATCH
IC4 Pin 9
Connect Oscilloscope To S1-9

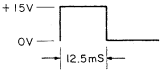


BOARD 29

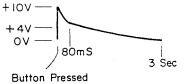
2 CYMBAL TRIGGER
IC8 Pin 3
Bosa Nova Playing



3 BRUSH TRIGGER
IC8 Pin 10
Bosa Nova Playing



4 CRASH CYMBAL DRIVER
Emitter Q9
Press Crash Cymbal Pushbutton



SCHEMATICS 30, 31

BOARD 9

1 VOLUME REGULATOR DRIVER

Emitter Q17

Minimum Volume = −14V
Maximum Volume = −7.25V

Note: Will vary depending on setting of Min. & Max. Volume Adj.

2 OUTPUT AMP VOLUME LEVELS

The following chart is representative of each of the audio circuits.

1. Place all volume controls and volume tabs to full volume.
2. Connect a voltmeter to the emitter of Volume Regulator Driver Q17 (S4-7). Adjust expression pedal for reading of −7.5 VDC.
3. Press Speaker Cancel pushbutton.
4. Tabs or presets are activated one at a time.
5. Hold down the A2 Keyswitch on the upper and lower keyboards and the A Bass pedal.
6. Connect oscilloscope to appropriate pin of Socket 4 (Board 9) or Lug (Board 50).
7. Input coupling AC.
8. Voltages are approximate peak-to-peak readings ±10% Signal+Noise.
9. Adjust trigger level just above noise range. Noise level = .1V ±.05V P-P at Volume Regulators, .2V ±.1V P-P at Output Amplifiers. (Avg.)
10. For the Output Amplifiers voltage measurements of .6V or less are due to inherent bleed through of audio signal between amplifiers and are shown as zero.

		VOLUME REGULATOR BOARD 9					OUTPUT AMPLIFIERS (See Note 10) BOARD 50					
	TAB OR PRESET	Chorus 1 S4-4	Flute 1 S4-3	Main S4-1	Flute 2 S4-2	Chorus 2 S4-5	Chorus 1 Lug 1	Flute 1 Lug 2	Main Lug 8	Flute 2 Lug 7	Chorus 2 Lug 9	Bass Lug 12
Upper Keyboard	Flute 8	0V	.2V	0V	.2V	0V	0V	1.5V	0V	1.5V	0V	0V
	Flute 8 w/Chorus	.15V	.2V	.1V	.2V	.15V	1V	1.5V	1V	1.5V	1V	0V
	Clarinet 16	0V	.4V	.42V	0V	0V	0V	4V	4V	0V	0V	1.1V
	Clarinet 16 w/ Main Chorus	.4V	0V	.4V	0V	.4V	3.5V	0V	3.5V	0V	3.5V	1.2V
	Accordion	0V	.3V	.3V	0V	0V	0V	3V	3V	0V	0V	1.1V
	Vibes	.13V	.42V	.44V	0V	.13V	.5V	5.5V	5V	.7V	.5V	3V
	Solo Piano	.8V*	0V	.8V*	0V	.8V*	9V*	0V	9V*	0V	9V*	5V*
	Solo Clarinet	.75V	0V	.75V	0V	.75V	6V	0V	7V	0V	6.5V	3.5V
	Orch. Gr. Piano	.5V*	1.2V*	1.3V*	1.3V*	.5V*	5V*	14V*	15V*	14V*	5V*	4V*
	Orch. Trumpet	1.2V	0V	0V	0V	1.2V	15.5V	0V	0V	0V	15.5V	1.4V
	Symp. Viola	.4V	0V	.4V	0V	.4V	4.5V	0V	4.5V	0V	4.5V	.7V
Lower Keyboard	Symp. Viola	.35V	0V	.4V	0V	.4V	3.5V	0V	3.5V	0V	3.5V	0V
	Flute 8	0V	.3V	0V	.3V	0V	0V	2.6V	0V	2.6V	0V	0V
	Flute 8 w/Chorus	.2V	.3V	.15V	.3V	.2V	1.5V	2.6V	1.5V	2.6V	1.5V	0V
	Diapason	0V	.22V	.15V	0V	0V	0V	2.8V	2.8V	0V	0V	0V
	Piano	0V	.35V	.4V	0V	0V	0V	4.2V	4.5V	0V	0V	0V
Pedal	Pedal 8	0V	0V	.6V	0V	.35V	0V	0V	3.5V	0V	2.2V	13V
	Symp. Tuba	0V	0V	2V	0V	1.3V	0V	0V	25V	0V	17V	22V
	Double Bass	.9V	.25V	.9V	.25V	.9V	7.5V	1V	7.5V	.9V	7.5V	20V

* At Keydown

SCHEMATICS 30, 31 (Cont.)

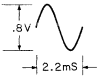
BOARD 9

3

FLUTE TO CHORUS INPUT PREAMP

IC7 Pin 4

Flute Chorus Tab On
U. K. Flute 8 Tab On
A2 Key Pressed

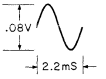


4

CHORUS AUDIO MIXER

IC7 Pin 3
Connect oscilloscope to S8-4

Flute Chorus Tab On
U. K. Flute 8 Tab On
A2 Key Pressed

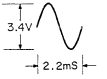


5

SQUELCH AMPLIFIER

IC6 Pin 4

Flute Chorus Tab On
U. K. Flute 8 Tab On
A2 Key Pressed

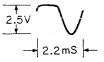


6

FULL WAVE RECTIFIER

IC6 Pin 3

Flute Chorus Tab On
U. K. Flute 8 Tab On
A2 Key Pressed

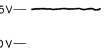


7

FILTER

IC6 Pin 12

Flute Chorus Tab On
U. K. Flute 8 Tab On
A2 Key Pressed



8

COMPARATOR

Connect voltmeter
to IC6 Pin 10

Flute 8 Tab On
Flute Chorus Tab On

Normal = +13.5V

Any Upper
Keydown = −13V